NEW BRUNSWICK
DEPARTMENT OF MUNICIPAL AFFAIRS & ENVIRONMENT
ENVIRONMENTAL MANAGEMENT, LAND & WATER USE DIVISION
WATER RESOURCE PLANNING BRANCH

WATERCOURSE ALTERATIONS TECHNICAL GUIDELINES

JANUARY, 1987

PROVINCE OF NEW BRUNSWICK
DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT
ENVIRONMENTAL MANAGEMENT, LAND & WATER USE DIVISION
WATER RESOURCE PLANNING BRANCH

WATERCOURSE ALTERATIONS
TECHNICAL GUIDELINES

Prepared By:

THE NEW BRUNSWICK WATERCOURSE ALTERATION
TECHNICAL COMMITTEE

ACKNOWLEDGEMENT

The preparation of these Watercourse Alteration Guidelines for New Brunswick has been carried out by representatives of both Provincial and Federal government agencies over a period of several years. Since this group of people has been subject to change from time to time, the acknowledgement of their participation is limited to the agency represented.

Water Resource Planning Branch
Environmental Management, Land & Water Use Division
N.B. Department of Municipal Affairs and Environment

STRUCTURES DIVISION
N.B. Department of Transportation

THE DEPARTMENT OF FISHERIES AND OCEANS
CANADA

FISH AND WILDLIFE BRANCH
N.B. Department of Natural Resources & Energy

FORESTS BRANCH
N.B. Department of Natural Resources & Energy

ENGINEERING BRANCH
N.B. Department of Agriculture

PREFACE

These Guidelines have been prepared to complement the Watercourse Alteration Regulation 82-233 under the New Brunswick Clean Environment Act; Chapter C-6, R.S.N.B. 1973.

The Guidelines contain explanatory information which is intended to provide guiding principles for those people planning a watercourse alteration or reviewing a proposed alteration. While providing guidance there is no intention of providing a code for design. Throughout the guidelines, references to texts and handbooks are found while the guidelines indicate the appropriate checks, evaluations and provisions needed to plan an alteration and document an application for a Watercourse Alteration Permit.

Since it is recognized that review and revision of these Guidelines will likely be required from time to time, the information has been prepared on a project-type basis. Comments and constructive criticism are invited. As appropriate, amendments will be issued to individual portions of the Guidelines.

TABLE OF CONTENTS

Page
Acknowledgement . . . . i.
Preface . . . . ii.
Table of Contents . . . . iii.

CHAPTER
1. INTRODUCTION. . . . . 1.
2. GENERAL GUIDELINES. 8.
3. SPECIFIC GUIDELINES FOR WATERCOURSE ALTERATIONS. . . . . . 9.

Major Obstructions

Dams and Barrages . . . . 10.
Water Control Structures. . . . . 11.
Causeways . . . . 12.

Minor Obstructions

Bridges . . . . 13.
Constrictions . . . . 15.
Breakwaters . . . . 17.
Wharves, Quays and Piers. . . . . 18.
Land Extensions . . . . 19.
Culverts and Pipe Arches. . . . . 20.

Major Alterations

Dredging. . . . . 26.
Canals. . . . . 28.
Cutoffs . . . . 29.
Stream Diversions . . . . 31.
River Adjustments . . . . 33.
Settling Ponds. . . . . 34.
Channel Cleaning. . . . . 35.

TABLE OF CONTENTS ... cont'd

Minor Alterations

Page

Debris Removal. . . . . 37.

Tree and Brush Removal Within 10 m of the Bank. . . . . . . 40.

Landing Stages. . . . . 42.

Fords . . . . 43.

Beaches . . . . 45.

Instrument Pools and Wells. . . . . 47.

Pipeline Crossings. . . . . 48.

Water Intake Structures . . . . 50.

Ponds, By-pass Variety. 52.

Farm Ponds of the Dugout Variety. . . . . 54.

Pool Restoration. . . . . 55.

Rock Placement. . . . . 58.

Pool Creation . . . . 59.

Protective Works

Erosion Control Works . . . . 60.

Floodwater Diversion Channels (floodways) . . . . 63.

Flood Protection Works. 64.

Removal of Works

Removal of Major Obstructions . . . . 65.

Removal of Minor Obstructions and Alterations . . . . 66.

Removal of Protective Works . . . . 67.

Drainage

Draining of Lakes, Swamps and Wetlands. . . . . 68.

Miscellaneous Drainage Changes. . . . . 69.

Subdivisions and Alignments . . . . 70.

4. LEGISLATED PROJECT CONSTRAINTS. . . . . 71.

5. FISHERY CONCERNS. . . . . 79.

APPENDICES

APPENDICES

Page
A. REFERENCES. . . . . 84.
B. DEFINITIONS . . . . 86.
C. "BEFORE YOU ALTER A WATERCOURSE". . . . . 107.
D. PROCEDURAL INFORMATION REGARDING PROCESSING OF APPLICATION . . . . 111.
E. INFORMATION REQUIREMENTS. . . . . 119.
F. THE COMMITTEES. . . . . 132.

CHAPTER 1

INTRODUCTION

1.1 GENERAL

New Brunswick is blessed with many beautiful watercourses which provide sanctuary for abundant fish and wildlife and which are increasingly used by man for recreation and water supply. Unfortunately, activities are often undertaken - which affect the watercourse in various ways - by people who do not consider or realize that changes made to a watercourse may result in a risk to life, to other people's property, to the fishery resource and to the quality of water.

1.2 THE WATERCOURSE ALTERATION PROGRAM

In order to ensure that property rights are protected and that no unnecessary damage to the aquatic habitat occurs, the Watercourse Alteration Regulation was filed. This Regulation stipulates that the potential effects of a watercourse alteration are adequately considered at the design stage.

The Watercourse Alteration Regulation under the Clean Environment Act stipulates that a permit be issued for the alteration of a watercourse. The N.B. Fish and Wildlife Act and the Canada Fisheries Act also stipulates that approval for watercourse alterations be obtained. In order to simplify the application process, it is only necessary to apply once to the New Brunswick Department of Municipal Affairs and Environment. During the review of applications for watercourse alteration permits, advisory agencies are routinely requested by the New Brunswick Department of Municipal Affairs and Environment, which is the regulatory agency to comment on the possible environmental and other effects of a proposed watercourse alteration. The Fish and Wildlife Branch of the Department of Natural Resources and Energy and the Department of Fisheries and Oceans act as advisory agencies.

Representatives of the above agencies, together with the Department of Transportation, the Department of Agriculture, and the Department of Tourism, Recreation and Heritage, comprise the New Brunswick Watercourse Alteration Advisory Committee. This Committee advises the Department of Municipal Affairs and Environment on applications and any other matters relating to the watercourse alteration program.

1.3. GUIDELINES OBJECTIVE

The Technical Guidelines contained herein have been prepared by the New Brunswick Watercourse Alteration Technical Committee (1976) with the goal of providing guiding principles for those people planning or reviewing a watercourse alteration project.

1.4 LIMITATIONS ON USE OF THESE GUIDELINES

The following limitations are placed on the use of these Guidelines:

1. the Guidelines are not to be interpreted as a method of design or a design code;
2. following these Guidelines does not exempt a person from liability for any damage resulting from the completion of the watercourse alteration project, or from the requirement to obtain a permit when one is required pursuant to the Watercourse Alteration Regulation; and
3. following these Guidelines places no liability for the design, planning or construction of any watercourse alteration on the Minister, the Department of Municipal Affairs and Environment or the Province.

1.5 GUIDELINES OF WATERCOURSE ALTERATIONS

Experience has shown that watercourse alterations may be classed into five general categories. Each category includes a variety of watercourse alteration projects. Table 1.1, which follows, shows the types of alterations assigned to each category. The Table further shows for each of the alteration types whether or not an application for a Watercourse Alteration Permit will be reviewed by inter-departmental consultation between the regulatory and advisory agencies or solely by the regulatory agency. It should be noted that only those "types" for which guidelines for aquatic habitat protection can be developed are exempt from advisory agency investigation. Also, for the benefit of applicants and agencies, the Table indicates the type of documents which should accompany each application.

1.6 GUIDELINES

Chapters 2 and 3 present the General and Specific Guidelines for Watercourse Alterations. Each guideline is referenced by category and type of alteration at the top of the page. This reference coincides with Table 1.1 and other listings of information used in the program. A set of guideline statements, notes, applicable definitions and a commentary comprise each Specific Guideline. This format allows one guideline to be used separately from the other Specific Guidelines depending on the particular alteration "type" although some cross-referencing appears.

LIST OF DOCUMENTS REQUIRED WITH THE SUBMITTAL OF APPLICATIONS FOR WATERCOURSE ALTERATION PERMITS

The following pages give a listing by watercourse alteration type of the documents required with submittal of an application for a Watercourse Alteration Permit. The documents are required to allow fair and adequate review of proposed watercourse alteration projects. Failure to submit required documents would result in the return of the application without it being processed.

Definitions:

For this list the following definitions are deemed to apply:

"Engineering Scale Drawings" means fully dimensioned scale drawings prepared with the use of drafting instruments and showing all dimensions necessary to describe the size, shape, and alignment of the proposed watercourse alteration. These drawings must be prepared by or under the direct supervision of a person licenced to practice as a Professional Engineer in New Brunswick, pursuant to the Engineering Profession Act. The drawings must bear the seal of the Professional Engineer.

"Drawings to Scale" means fully dimensioned scaled drawings prepared with the use of drawing instruments and showing all dimensions necessary to describe the size, shape, and alignment of the proposed watercourse alteration.

"Dimensioned Sketches" means free hand drawings with all the dimensions necessary to describe the size, shape, and alignment of of the proposed project.

TABLE 1.1: APPLICATION REVIEW REQUIREMENTS

CATEGORY	GROUP	TYPE	REGULATORY & ADVISORY	REGULATORY ONLY	REQUIRED DOCUMENTATION
OBSTRUCTIONS		MAJOR			
1	A	Dams and Barrages	X		Specifications Engineering scale drawings (plan, profile, x-section)
1	B	Water control structures	X		Specifications Engineering scale drawings (plan, profile, x-section)
		Aboideaux	X		
		Fishways	X		
		Flumes	X		
		Aquaducts	X		
		Sluiceways	X		
		Spillways	X		
		Weirs	X		
		Fish screens	X		
		Navigation Locks	X		
1	C	Causeways	X		Drawings to scale (plan, profile, x-section)
OBSTRUCTIONS		MINOR			
1	D	Bridges		X	Drawings to scale (plan, profile, x-section)
1	E	Constrictions		X	Drawings to scale (plan, profile, x-section)
1	F	Breakwaters Wharves Land Extensions		X	Drawings to scale (plan, profile, x-section)
1	G	Culverts and Pipe arches		X	Dimensioned sketches showing size, alignment and slope.

TABLE 1.1.... con't

CATEGORY	GROUP	TYPE	REGULATORY & ADVISORY	REGULATORY ONLY	REQUIRED DOCUMENTATION
MODIFICATIONS		MAJOR			
2	A	Dredging	X		Engineering scale drawings (plan, profile, x-section)
2	B	Canals Cutoffs Channelization Diversions Re-routing River adjustment	X		Bed material analysis Engineering scale drawings (plan, profile, x-section)
2	C	Settling ponds Channel Cleaning	X		Dimensioned sketches
MODIFICATIONS		MINOR			
2	D	Debris removal Tree and Brush removal within 10 metres of bank		X	Dimensioned sketches Full description
2	E	Landing stages Fords Beaches		X	Dimensioned sketches Full description
2	F	Instrument pools and wells Pipe line crossings Water intake structures		X	Drawings to scale (plan, profile, x-section)
2	G	By-pass ponds, Farm ponds, dugout type		X	Drawings to scale (plan, profile, x-section)
2	H	Pool restoration Rock placement Pool creation	X		Drawings to scale (plan, profile, x-section)

TABLE 1.1 ... con't

CATEGORY	GROUP	TYPE	REGULATORY & ADVISORY	REGULATORY ONLY	REQUIRED DOCUMENTATION
PROTECTIVE WORKS					
3	A	Erosion Control Including; rip-rap, gabions, crib work		X	Dimensioned sketches and full description
3	B	Floodways, floodwater diversion channels Flood Protection works	X		Bed material analysis Engineering scale drawings (plan, profile, x-section)
REMOVAL OF WORKS					
4	A	Obstructions including those listed 1A and 1C		X	Drawings to scale (plan, profile, x-section)
4	B	Minor obstructions and Alterations to environment 1D to 2H		X	Dimensioned sketches and a description of works.
DRAINAGE					
5	A	Draining of ponds, lakes and swamps	X		Drawing to scale and a description of proposed changes
5	B	Miscellaneous drainage changes		X	Dimensioned sketches and a full description of proposed changes
5	C	Subdivisions and alignment	X		Drawing to scale and a full description of proposed changes

CHAPTER 2

APPLICABLE TO ALL WATERCOURSE ALTERATIONS GUIDELINES

REVISED: MARCH 1984

GENERAL GUIDELINES

There are common practices which should be followed in all types of watercourse alteration projects in order to maintain the streambed in as natural a state as possible. Where required, timing and specific methods will be prescribed in the W/A permit issued by NBDM&E. The general guidelines are listed below:

1. All work operations shall be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream areas.

2. Any debris and excavated material resulting from the construction process shall be removed from the watercourse and adjacent areas and be disposed of, or placed in a manner where it cannot be returned to the watercourse. Sites should be cleaned up and left in a neat condition.

3. Heavy equipment operations in the watercourse shall be maintained at the minimum that is necessary to carry out work operations. Unnecessary fording shall not be carried out.

4. All necessary precautions shall be taken to prevent the discharge or loss of any harmful material or substance into the watercourse; including but not limited to creosote, hydrocarbons, biocides, fresh cement, lime, paint, or concrete.

5. Exposed erodable material resulting from construction operations should be stabilized against erosion.

6. Machinery and pollutants must be located or stored in areas not in danger of floodwaters. Machinery in use shall be located so that in case of a flash flood it can be removed from the flood areas.

CHAPTER THREE

SPECIFIC GUIDELINES FOR WATERCOURSE ALTERATIONS

TYPE: Dams and Barrages (1A)

REVISED: March 1984

GUIDELINES FOR DAMS AND BARRAGES

1. For all dams not capable of being safely overtopped by flood water or wind generated waves, the minimum acceptable freeboard shall be one half metre.

2. All dams not capable of being safely overtopped should have a spillway designed to pass the minimum flood discharge, as determined below unless it is demonstrated in writing by the design engineer that lesser spillway capacity is adequate and no risk to human life is thereby created.

   (i) freeboard less than one metre;

   $Q = 6.93\ A^{3/4}$ (Q in m^3/s and A in km^2)

   $Q = 500\ A^{3/4}$ (Q in cfs and A in mi^2)

   (ii) freeboard greater than one metre;

   $Q = 3.465\ A^{3/4}$ (Q in m^3/s and A in km^2)

   $Q = 250\ A^{3/4}$ (Q in cfs and A in mi^2)

3. Trees and slash shall be removed from the area to be flooded when creating a reservoir.

4. That 2/3 of the prevailing flow be maintained during construction and filling.

5. Under certain circumstances, flow requirements during construction and filling will be prescribed in the water-course alteration permit.

COMMENTARY:

All proposals for dams and reservoirs require inter-departmental consultation and detailed project review because of the significant effects most dams and reservoirs have on the natural environment. All dams must be designed by a person licenced to practice as a Professional Engineer pursuant to the Engineering Profession Act and who is experienced in hydrotechnical design. Where deemed necessary by the New Brunswick Department of Municipal Affairs and Environment, under certain circumtances such as low storage capacity, low head, low flood damages, etc. exceptions may be made.

TYPE: Water Control Structures (1B)
(aboideau, aquaducts, fishways, flumes, navigation locks, sluiceways, spillways, and weirs)

REVISED: March 1984

GUIDELINES FOR WATER CONTROL STRUCTURES

1. That 2/3 of the prevailing flow be maintained during construction.

2. Under certain circumstances, flow requirements during construction will be prescribed by the watercourse alteration permit.

COMMENTARY

Water control structures may affect river regime or equilibrium and consequently adversely affect fish habitat, man-made structures in or near the watercourse and/or water supply to downstream users.

Usually, water control structures must be designed to withstand considerable hydraulic loads and, therefore, must be designed by a Professional Engineer.

All water control structures must be designed by a person licenced to practice as a Professional Engineer pursuant to the Engineering Profession Act and who is knowledgeable of hydrotechnical design and construction. The purpose of this requirement is to encourage proper design of all water control structures so as to lessen their adverse effects on the environment and downstream riparian property. Where deemed necessary by the New Brunswick Department of Municipal Affairs and Environment, under certain circumstances, exceptions may be made.

Review of applications for Watercourse Alteration Permits for water control structures will involve inter-departmental consultation and detailed appraisal on an individual project basis.

TYPE: Causeways (1C)

REVISED: December 1976

GUIDELINES FOR CAUSEWAYS

1. embankment protected against erosion (see guidelines for erosion control) due to waves, ice and currents;
2. waterway openings sufficient to handle flood flows without flood damage to the causeway and the watercourse or property located in the floodway;
3. waterway opening sufficient so as not to adversely alter water levels; limits of water level affect will be specified for individual projects as required by local conditions;
4. waterway opening sufficient to prevent water stagnation in the separated bodies of water;
5. navigation not impeded by the completed structure;
6. causeway material nontoxic to aquatic life;
7. silt in causeway material kept to a minimum; and
8. construction and site clean-up as per general guidelines.

COMMENTARY

Causeways are normally associated with road work as an economic means of getting across a body of water. The impact of such a structure on the local watercourse environment is quite significant with regards to ice movement water levels, current patterns and littoral drift. Due consideration of location of a causeway across a body of water is necessary because the base of a causeway may cover a significant amount of prime fish nursery and/or feeding grounds. On the other hand, rubble for erosion control may provide habitat for marine life such as lobsters.

Causeways shall be designed and constructed so as to have minimum detrimental effects on the environment.

Consideration in the design of causeways shall be given to safety, flood discharges, backwater, erosion, navigation (Navigable Waters Protection Act), ice jamming, debris, water quality, fish movement and aesthetics.

TYPE: Bridges (1D)

REVISED: March 1984

GUIDELINES FOR BRIDGES

Regarding bridge design practice:

1. Encroachments into incised channels should be kept to a minimum.
2. Sufficient horizontal and vertical clearance must be provided so as not to encourage ice and debris jams or flooding.
3. Sufficient waterway opening should be provided so backwater does not create flooding problem.
4. Piers, bents and abutments should be aligned with stream flow.
5. Bank protection must be provided if bridge alignment results in deflection of flow against either bank.

Regarding bridge construction practice:

1. Not more than one-third of the stream channel cross-section shall be blocked at one time.
2. Excavation for the piers, footing and abutments should be conducted in such a manner as to keep the work area separated from the flowing stream.
3. Excavated materials shall not be allowed to enter the stream. Care must be taken during the placing and removal of cofferdams to prevent cofferdam material from washing into the stream.
4. Dewatering of work areas and areas behind cofferdams should be done so that the sediment is controlled (for example, pumped into a sediment trap) to prevent unnecessary siltation of the watercourse.
5. The sediment control facilities should have capacity to reduce the suspended solids in the effluent to a standard set by N.B. Department of Municipal Affairs and Environment.

6. Machinery and pollutants should be located or stored in an area so they cannot be exposed to flood waters from the stream. Machinery in use shall be located so that in the case of a flash flood, it can be removed quickly from the flood area.

7. The site shall be cleaned up as per the General Guidelines.

COMMENTARY

Bridges shall be designed and constructed so as to have minimum detrimental effects on the environment.

A Survey program for the design of a bridge should provide the following information:

(1) cross section of the channel at the bridge location, upstream and downstream of the bridge location.

(2) a plan of the existing channel showing the location of the proposed bridge, cross-section locations and bed material or other site test locations.

(3) the elevation of the historical extreme highwater, and

(4) a description or analysis of the bed material, (e.g. sand, clay, silt, gravel, ledge, etc.)

Consideration in the design of bridges shall be given to safety, flood discharges, backwater effects, scour, navigation clearance (Navigable Waters Protection Act), passing of ice and debris, ice jamming, fish movement, stream bank erosion and aesthetics.

Planned profile drawings to scale must be prepared for the proposed bridge. The drawings should show overall dimensions of piers, footings, distances between piers and abutments, scour protection works, guide banks and approach fills, clearance above extreme high water, skew angle of the bridge to the watercourse, and skew angle of piers to the watercourse.

Careful consideration should be given to the selection of a design flood. A minimum return period of one in 100 years is suggested.

The proponent should provide a description of alternatives considered in sufficient detail to allow the reviewer to comparitively evaluate environmental risks and the benefits and costs of all consideration.

The information obtained should be submitted with an application for a Watercourse Alteration Permit.

TYPE: Constrictions (1E)

REVISED: October 1976

GUIDELINES FOR CONSTRICTIONS

Regarding constriction design practice:

1. Encroachments into flood plains and incised channels should be kept to a minimum.

2. Backwater effects due to the constriction must be evaluated and minimized to the amount tolerable upstream of the constriction.

3. (a) Water velocity increases due to the constriction must be evaluated and minimized in accordance with anticipated scour effects.

   (b) Foundation conditions at the constriction site must be evaluated to insure against failure of embankments and channel blockage or diversion.

4. Banks of the constriction must be protected against scour and erosion.

5. (a) The constriction must be aligned so as not to direct flow into banks or create stagnant pools.

   (b) The constriction should not wrosen wave action in the channel.

6. The effect of the constriction on tidal variations should be considered.

Regarding constriction construction practice:

1. Not more than 1/3 of the design constricted watercourse cross-section shall be blocked at one time.

2. Excavation for foundations should be conducted in such a manner as to keep the work area separated from the watercourse. Excavated materials shall not be allowed to enter the watercourse. Care must be taken during placing and removal of cofferdams to prevent cofferdam material from washing into the stream.

3. Fill material should contain no toxic substances and only minimal amounts of silt and/or clay particles.

COMMENTARY:

Constrictions of watercourse are often necessary for economic or project design reasons. Commonly problems related to increased floodlevels upstream, jamming of ice and debris, channel scour, bank stability or erosion and tidal variations are encountered. Considerations in the design of constrictions should deal with these problems as well as safety, the size of the design flood and passage of it, navigation (Navigable Waters Protection Act), fish movement and aesthetics.

Constrictions should be designed and constructed so as to have minimal detrimental effects on the environment.

TYPE: Breakwaters (1F)

REVISED: November 1976

GUIDELINES FOR BREAKWATERS

1. Breakwaters shall be constructed in a fashion as to not interfere with known fish migration routes.
2. Breakwaters shall be constructed of material free of significant quantities of chemical elements or compounds toxic to aquatic life.
3. Constructed breakwaters shall be marked to minimize boating hazards.

COMMENTARY

Generally speaking, breakwaters should not be required in most New Brunswick rivers and lakes. When constructed, breakwaters should not impede free navigation or the flow of water.

Approval for the construction of breakwaters is required in most cases under the Canada Navigable Waters Protection Act.

Where rip-rap is used to protect the slopes of the breakwater embankment, the stone used for rip-rap shall be clean, non-orebearing, non-erodible material from a non-watercourse source.

TYPE: Wharves, Quays and Piers (1F)

REVISED: November 1976

GUIDELINES FOR WHARVES, QUAYS AND PIERS

1. On non-tidal portions of watercourses, wharves and piers for small boat mooring should be of the movable type, to be removed in the winter.
2. Wharves, quays and piers shall be constructed of material free of significant quantities of chemical elements or compounds toxic to aquatic life.
3. Wharves, quays and piers should not excessively obstruct free navigation or the flow of water.

COMMENTARY

Colloquially, the terms docks, wharves, and piers are often used interchangeably when by definition a pier is meant. Cottage owners on lakes, ponds and rivers construct piers which, if left, during the ice-in period are often smashed with a consequent increase in debris occurrance.

Generally speaking, proper selection of materials, construction and clean-up procedures are required for wharf, quay and pier construction.

TYPE: Land Extensions (1F)

REVISED: March 1984

GUIDELINES FOR LAND EXTENSION

1. Land extensions should be made with clean, non-ore bearing inorganic material and shall not be constructed with bark wastes, automobile bodies, or other material detrimental to aquatic life and water quality.

2. Land extensions shall be constructed in a fashion as to not interfere with known fish migration routes.

3. Banks of the land extensions must be protected against scour and erosion.

COMMENTARY

Land extensions, the filling of all or a portion of a waterway, is a form of watercourse constriction.

Care should be taken to ensure that the land artifically created by such land extension does not illegally impinge on public or private ownership rights - of it other private rights are involved that legally acceptable permission from such private owners has been obtained.

Land extensions should only be done in situations where public or private interests are not adversely affected. Included in these concerns are destruction of important fish or other aquatic or wildlife habitat, recreational areas, effects on other owners and water users.

The approval of the Ministry of Transport under the Canada Navigable Waters Protection Act is often required. A proponent of a land extension project should also contact the officials of the incorporated municipality in which the proposed land extension would be done, if applicable.

Applicants for Watercourse Alteration Permits are cautioned that filling of all or part of a waterway can, and usually does involve riparian law which is very complicated.

TYPE: Culverts and Pipe Arches (1G)

REVISED: March 1984

GUIDELINES FOR CULVERTS

Restrictions on the design of Culvert Structures

1. The minimum acceptable culvert for installation in an artificial channel shall be a circular pipe twelve inches in diameter (12 in. 0.30 m).

2. The minimum acceptable culvert that may be placed in a natural watercourse, or in an artificial channel constructed for reasons other than surface drainage, shall be a circular pipe thirty inches in diameter (30 in. 0.76 m). This guideline also applies to culverts installed as part of a multiple culvert installation.

3. The backwater resulting from a culvert installation shall be limited to an amount which will not cause damage to upstream property.

4. The unit discharge used for the selection of culvert size shall not be less than 1.6 cubic meters per second per square km of drainage area, except where justified in detail by a person licensed to practice as a Professional Engineer, pursuant to the New Brunswick Engineering Profession Act.

5. The embankment in which the culvert is placed must be designed by a person licensed to practice as a Professional Engineer, pursuant to the New Brunswick Engineering Profession Act if:

   (i) the design headwater to diameter ratio of any circular culvert exceeds 1.5;

   (ii) the design headwater to rise ratio of any arch or pipe arch exceeds 1.0;

   and (iii) the embankment is greater than ten meters (32.8 feet) in height.

6. The culvert alignment should follow that of the watercourse. If not, downstream bank protection must be evaluated and provided if required.

7. Inlets or outlets shall be stabilized against erosion with riprap or other appropriate materials to the top of the pipe and a minimum of one pipe diameter on each side of the pipe.

Considerations in the Size Selection of Culverts

"Attributes of a Good Highway Culvert"

The American Society of Civil Engineers Task Force on Hydraulics of Culverts, offers the following recommendations for "Attributes of a Good Highway Culvert".

1. The culvert, appurtenant entrance and outlet structures should properly take care of water, bed-load and floating debris at all stages of flow.

2. It should cause no unnecessary or excessive property damage.

3. Normally, it should provide for transportation of material without detrimental change in flow pattern above and below the structure.

4. It should be designed so that future channel and highway improvement can be made without too much loss or difficulty.

5. It should be designed to function properly after till has caused settlement.

6. It should not cause objectionable stagnant pools in which mosquitoes may breed.

7. It should be designed to accommodate increased runoff occasioned by anticipated land development.

8. It should be economical to build, hydraulically adequate to handle design discharge, structurally durable and easy to maintain.

9. It should be designed to avoid excessive ponding at entrance which may cause property damage, accumulation of drift, culvert clogging, saturation of tills, or detrimental upstream deposits of debris.

10. Entrance structures should be designed to screen out material which will not pass through the culvert, reduce entrance losses to a minimum, make use of the velocity-of-approach insofar as practicable, and by use of transitions and increased slopes, as necessary, facilitate channel flow entering the culvert.

11. The design of inlet and outlet should be effective in re-establishing tolerable non-erosive channel flow within the right-of-way or within a reasonably short distance below the culvert.

12. The outlet should be designed to resist undermining and washout.

13. Energy, dissipaters, if used, should be simple, easy to build, economical and reasonably self-cleaning during periods of easy flow.

CONSIDERATIONS REGARDING THE INSTALLATION OF CULVERTS

1. Maximum desirable slope of culverts is .5 meters per 100 lineal meters(0.5%). In cases where this requirement cannot be met when the pipe is laid on the stream gradient, pipe arches, arches, interior baffling, or stilling basins should be considered to maintain adequate depth of flow and velocity to ensure proper conditions for fish passage.

2. The culvert should be installed on a uniform slope, and the invert be set .5 to .15 meters below natural streambed level.

3. In the case of the installations involving multiple culverts, it is recommended that the floor of one culvert be set .15 meters lower than the adjacent structures.

4. The construction work area should be separated from the flowing stream but cofferdam material should be kept from entering the stream.

5. Provisions must be made to pass fish around the construction area. Diversion channels must be provided for large culvert installations. (Refer to Guidelines under Diversions).

COMMENTARY

The New Brunswick Department of Municipal Affairs and Environment has proposed the guidelines on culverts as part of an effort by that Department to lessen the needless environmental damages that have been typical of these projects in the past.

The Department prefers permanent rather than temporary culvert installations on large streams. The construction of properly designed bridges rather than the installation of culverts is also preferred.

FISH PASSAGE

To analyze culverts for fish passage the following must be considered:

1. Entrance conditions
2. Limiting velocity and depth
3. Length of the culvert

If the invert elevation of the culvert is too high above the downstream water surface, it may be impossible for fish to enter the culvert. This drop is limited by the fish's swimming velocity capability, jumping ability, and the depth available for sounding at the downstream end.

The ability of a fish to pass through a culvert is limited by the velocity and depth of flow and also the length of the culvert through which the fish can sustain swimming speed. Minimum water depth required is considered to be six to nine inches. Obviously, the fish swimming speed must exceed the water velocity in order to pass through the culvert. Generally, 4 fps should be considered to be the upper limit for velocity for fish passage through culverts.

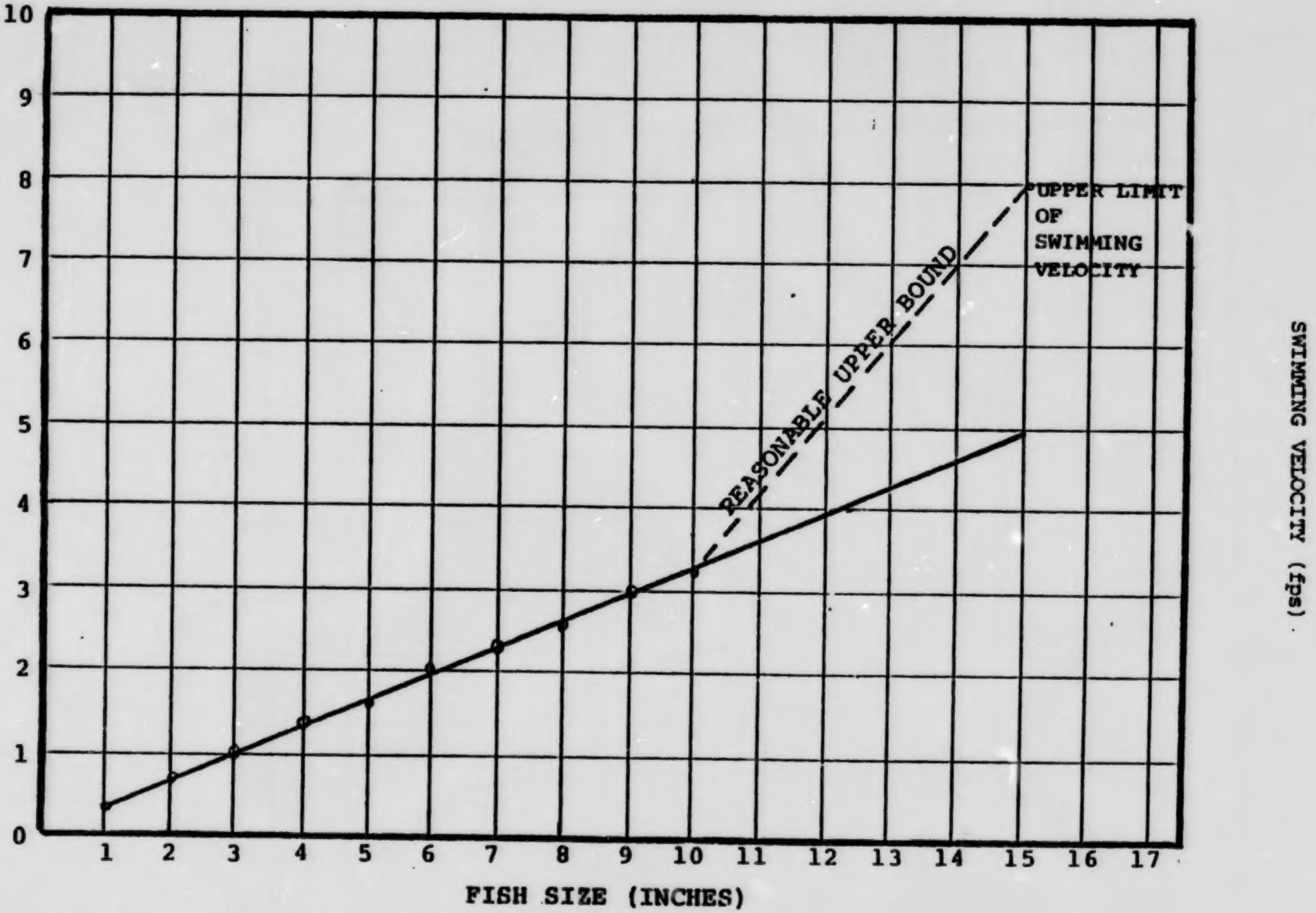


FIGURE 3.10.1 FISH SIZE Vs SUSTAINED SWIMMING VELOCITY FOR 20 SEC. DURATION AFTER METSKER (1970) DATA.

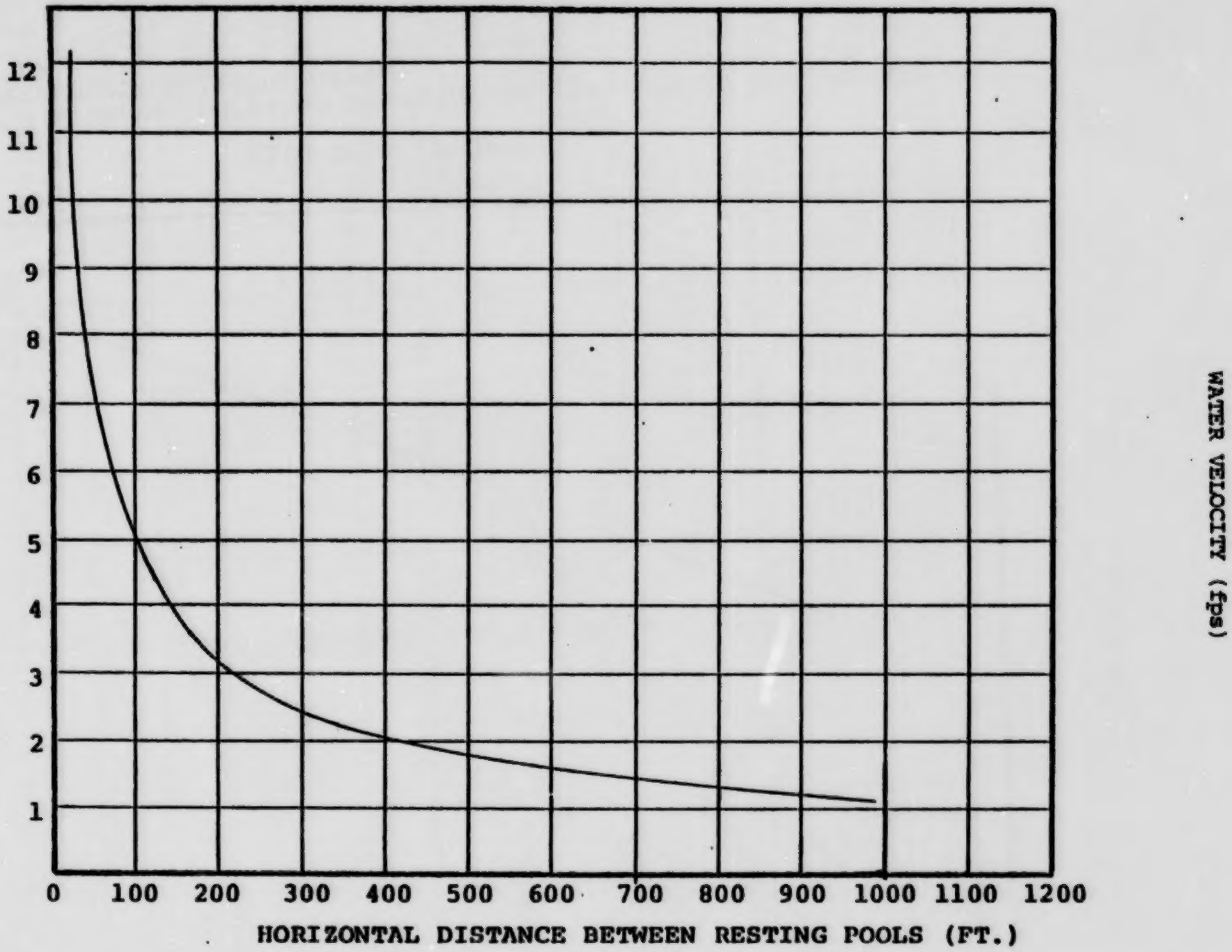


FIGURE 3.10.2 WATER VELOCITY Vs SWIMMING DISTANCE WITHOUT RESTING (SALMON & LARGE TROUT) AFTER METSKER (1970) DATA.

TYPE: Dredging (2A)

REVISED: October 1976

COMMENTARY

Dredging is the act of removing material from the bed of a watercourse; specifically for the purpose of improving navigability of the channel.

Dredging is a complex and detailed science which still relies on experienced personal judgement. For that reason, specific guidelines (other than the general guidelines) have not been presented. However, particular attention should be paid to the general guidelines referring to siltation and disturbance of the stream. Dredging projects must be supervised by a Professional Engineer.

Environmental Problems

Environmental problems associated with dredging are:

1. adjustments in river regime
2. changes in water quality due to increased turbidity and activation of dormant organic matter, and
3. damage to the aquatic habitat such as the covering of fish eggs by increased sediment.

For all but the most minor dredging projects, it is strongly recommended that an environment impact statement be prepared. Agitation dredging refers to the dragging of a stick or anchor along the bed of a watercourse and allowing the sediment to be carried away by the flowing water. Reasons why this method should not be considered are the effects on fisheries due to sediment covering fish eggs, and the effects of increase sediment on river regime.

Maximum Depth of Dredging

The maximum depth of dredging is more often defined by navigation requirements rather than environmental concerns. For a particular case, it may be defined according to environmental concerns.

Timing of Dredging

Dredging should generally be carried out in low flow periods in August and early September in order to avoid problems with fish migration and spawning. However, this might present major problems in dredging navigation. Timing should be determined for each individual case by investigation.

Disposal of Spoils

Spoils, the material removed from the watercourse, can be disposed by one of the following methods:

1. open water disposal - placing spoils into a deep portion of the watercourse where it will not interfere with navigation,
2. enclosed basins - placing spoils into a dyked area to reduce contamination of the watercourse,
3. onshore disposal - placing spoils on the land away from the banks of the watercourse, and
4. marshland reclamation.

Generally speaking, disposal of the polluted dredged material away from the watercourse is preferable from the environmental point of view. The dredged material should be revegated as soon as possible after deposition.

SUMMARY

Dredging operations are complex. Due to this complexity no specific guidelines (beyond the General Guidelines) have been prepared. Individual dredging projects have to be individually assessed for possible damage to the environment.

TYPE: Canals (2B)

REVISED: February 1977

COMMENTARY

Canals are large artificial channels usually constructed for water transport purposes or conveyance of water from one destination to another. They should be designed to operate without extensive maintenance and with a minimum of environmental risks such as water quality problems to the receiver watercourse. Specific guidelines have not been developed as yet; however, reference to the general guidelines should be made.

TYPE: Cutoffs (2B)

REVISED: February 1977

GUIDELINES FOR CUTOFFS

1. Construction should be done during low water months, typically, July through September.
2. Excavation shall be carried out in the day from the downstream end. Pilot cut methods are not acceptable.
3. The existing channel is to be left untouched until the cutoff channel is completed.
4. The upstream end of the old channel must be closed off with non-porous and non-erodable material for the design condition of flow. If the old channel is not filled in as part of the project the upstream blocking structure must be stable as designed.
5. If a tributary stream enters the old channel along the reach by-passed by the cutoff, provision shall be made in the project design to connect the tributary, by an appropriate designed channel, to the main channel.

DESIGN

In carrying out the engineering design, the following is suggested:

A. The hydrology of the site should be developed from records for the site if available or from a similar watershed where information is available.

B. Carry out any field survey in accordance with accepted river engineering survey procedures. This includes the physical characteristics of the stream, sampling of bed material, flow controls such as bedrock outcrops, bridges, etc., discharge and suspended sediment measurements and documentation by photographs.

C. Engineering design calculations should be carried out to develop a channel with a stable width as related to the river slope, bankfull discharge and depth.

If the existing upstream and downstream channels are stable, their physical characteristics may be utilized as a guide in stable design of the cutoff channel. If these sections are unstable then the design can be done by the tractive force or a regime-type approach.

If it is simply necessary to relocate a channel then a diversion rather than a cutoff should be provided. See Guidelines for Diversions.

D. Estimates should be made on initiation of motion, bed load transport and the need for bank protection measures.

If initiation of motion is determined to occur at levels below bankfull stage or the two year flood then bed load transport should be estimated.

ANGLE OF APPROACH

The angle of approach should be kept to a minimum and it is recommended that 15° be used as a normal maximum and 25° as an absolute maximum.

COMMENTARY

All cutoffs should be properly designed to minimize or prevent adverse changes in river regime, downstream flooding, bank erosion and increase in sediment load.

ENVIRONMENTAL PROBLEMS

A cutoff could cause problems with flooding downstream due to the increased flow capacity caused by the higher slope. If valuable property is located downstream, this flooding potential could be a reason for refusal of the work. The increased discharge rates could also worsen bank erosion downstream and cause degradation upstream.

The removal of a section of natural watercourse from the aquatic environment and the increase in sediment load could be detrimental to fish habitat and could be cause for rejection of the application.

REVIEW

Review of the applications for Watercourse Alteration Permits for cutoffs requires extensive review. Engineering drawings and calculations should be submitted with the application.

TYPE: Stream Diversions (Rerouting of Rivers) (2B)

REVISED: March 1984

GUIDELINES FOR STREAM DIVERSIONS

1. Construction should be done during low water months, typically, July through September.

2. Excavation shall be carried out in the dry from the downstream end. Pilot cut methods are not acceptable.

3. The existing channel is to be left untouched until the cutoff channel is completed.

4. The upstream end of the existing channel must be closed off with non-porous and non erodable material for the design flow.

5. The existing or old channel must be backfilled with clean fill throughout the full length of the diverted reach.

6. If a tributary stream enters the old channel along the reach by-passed by the cutoff, provision shall be made in the project design to connect the tributary, by an appropriate designed channel, to the main channel.

7. The diversion channel should physically resemble the diverted channel if it is observed to be stable. Similar hydraulic elements should be retained in the diversion channel. Extra channel elements (tree cover, rip-rap, stream improvement devices) may also be required.

DESIGN

In carrying out the engineering design, the following is suggested:

A. The hydrology of the site should be developed from records for the site if available or from a similar watershed where information is available.

B. Carry out any field survey in accordance with acceptable river engineering survey procedures. This includes the physical characteristics of the stream, sampling of bed material, flow controls such as bedrock outcrops, bridges, etc., discharge and suspended sediment measurements and documentation by photographs.

C. Engineering design calculations should be carried out to develop a channel with a stable width as related to the river slope, bankfull discharge and depth.

If the existing upstream and downstream channels are stable, their physical characteristics may be utilized as a guide in stable design of the cutoff channel. If these sections are unstable then the design can be done by the tractive force or a regime-type approach.

If it is simply necessary to relocate a channel, then a diversion rather than a cutoff should be provided.

D. Estimates should be made on initiation of motion, bed load transport and the need for bank protection measures.

If initiation of motion is determined to occur at levels below bankfull stage or the two year flood then bed load transport should be estimated.

ANGLE OF APPROACH

The angle of approach should be kept to a minimum and it is recommended that 15° be used as a normal maximum and 25° as an absolute maximum.

COMMENTARY

Stream Diversions as categorized here include relocation works to change the local position of a watercourse. This is distinguished from a cutoff in that no necessity for decreasing the watercourse length exists although such a shortening may be economic or convenient to the diversion. Watershed to watershed transfer of runoff is dealt with as Rerouting of Rivers.

Diversions can be and usually are a major source of sediment which results in water quality and environmental damage downstream. Unless carefully designed and constructed diversions will not be approved or serve their intended purposes well.

Rerouting of Rivers, for the purpose of these guidelines, is taken to mean the extra-basin transfer of water via channels and/or other works to make the transferred water available for use in the receiver basin. Since such projects are normally large and have sizeable potential disbenefits to other resources it can be expected that a detailed design, review and impact assessment would be required prior to granting of approval.

TYPE: River Adjustment (2B)

REVISED: April 1977

GUIDELINES FOR RIVER ADJUSTMENT

1. Refer to the guidelines for other Alteration types under this Category and Group.
2. River adjustments should not reduce the hydraulic stability of the channel.

NOTE:

River adjustments usually are planned for large scale projects and involve major channel reaches. As such it is likely that a detailed Environmental Impact Assessment may be required prior to approval of the work.

The proposal should be prepared by a Professional Engineer licensed to practice in New Brunswick and who is a specialist in the field of hydraulics and river engineering. Project guidelines will be detailed for each proposal.

COMMENTARY

As categorized here River Adjustment is taken to encompass channelization projects, broad scale projects for river training works in a river basin as a whole, canal system projects, etc.

These are distinguishable from other types of projects in this category and these guidelines largely on the basis of their scope and the major effects that would result.

River adjustments involves changes to an existing channel's width and/or depth. However, this work may result in adverse effect on the fishery environment and the domestic or industrial use of the water.

The destruction of normal pools, riffles and side channels may result, which provide feeding areas and protection to fish. The removal of stream side vegetation could result in the absence of shelter and lack of food. Removal of shade trees could also cause a rise in water temperature which may prevent spawning or have lethal effects on fish life. Heavy equipment operating in the watercourse may cause disturbance or destruction of fish and/or fish eggs in the stream. This could also be caused by an increase in sediment load to the river.

Also the effects of channelization may affect other wildlife habitat and result in an aesthetically unpleasing landscape. As a solution to erosion problems, bank protection, rather than channelization is preferable.

TYPE: Settling Ponds (2C)

REVISED: April 1977

GUIDELINES FOR SETTLING PONDS

1. Settling ponds of approved capacity are required for any private or commercial operation involving large amounts of water, which carry mineral, organic or chemical solids.

2. Settling ponds for gravel washing (or other purposes) must be located a minimum of thirty metres from any stream bank as horizontally measured from the top of the nearest internal slope of the settling pond to the top of the streambank. The design capacity and performance of settling ponds for gravel washing must conform to the requirements of the Environmental Protection Branch, Environmental Management, Land & Water Use Division of the New Brunswick Department of Municipal Affairs and Environment.

COMMENTARY

Settling ponds are required in connection with gravel washing plants; such settling ponds must be of a size (area and depth) to ensure that clean (sediment-free) wash water is returned to the watercourse at all production rates. Settling ponds are also necessary to trap sediments resulting from extensive land clearing operation. Typical land clearing operations can be highway construction, agricultural practices, forestry operation and housing and industrial development.

Sediment or other type particle removal is essential to prevent fish, fish egg or aquatic insect destruction; impairment of downstream water quality and unsightly watercourse conditions. Settling ponds should be designed to have an adequate storage and retention capacity to prevent excess sedimentation of the natural watercourse during all run-off levels. The storage planned, the type of structure required and the control works must be designed to suit the individual case.

In addition to the use of settling ponds, measures can be taken to prevent sedimentation such as reducing gradient of slopes, and seeding and stabilization of slopes as soon as possible during construction. Contour ploughing practices and/or terracing can be followed for agricultural operations.

TYPE: Channel Cleaning (2C)

REVISED: March 1984

GUIDELINES FOR CHANNEL CLEANING

1. Channel cleaning is restricted to the months of June to September (inclusive) except in rare emergency situations when a provisional permit may be issued.

2. Channel cleaning or the removal of silt, sand and gravel from the bed or banks of a watercourse for the purpose of bridge and culvert maintenance, when permitted, will be restricted to fifteen meters up and downstream of the structure in question.

3. Channel cleaning by a riparian landowner may be permitted in exceptional circumstances. It shall be restricted to the portion of a watercourse bordering the property of the riparian owner.

4. All materials removed from the stream must be moved above the high water mark or disposed of in such a way so it will not re-enter the stream.

5. Where deemed necessary for hydrological reasons, gravel may be removed from the bed of the Watercourse under the supervision of NBDMA&E.

6. Materials removed in the process of legal channel cleaning may not be used for commerical or private purposes (Watercourse Alteration Regulations).

NOTE:

The deepening or the creation of new fish pools are not considered channel cleaning projects.

COMMENTARY

Channel cleaning refers to the excavation of material from the bank or bed of a watercourse. It is considered to differ from dredging in that it is not connected with navigation and is usually smaller in scale.

As indicated in these guidelines, stream gravel is essential as spawning areas for certain fish species, most importantly, Atlantic Salmon and brook trout. Very few streams in New Brunswick could withstand even small amounts of instream gravel mining and still have adequate spawning area left to maintain an adequate salmonid population.

The use of material from a watercourse is restricted by section 4 of the Watercourse Alteration Regulation. This section prohibits the sale of material from the watercourse or the transformation of the material into a commercial product.

Where possible, gravel removal projects should be limited to a distance of 30 metres from the watercourse. An exclusion zone of 30 metres from the bank of a watercourse is necessary to reduce the possibility of a watercourse eroding through to and flooding a gravel pit close to a watercourse, to reduce erosion from such mined areas, and to reduce unnatural channel change, due to such work.

TYPE: Debris Removal (2D)

REVISED: March 1984

GUIDELINES FOR DEBRIS REMOVAL

General

1. Debris means materials foreign to the normal composition of a stream's substrate such as car bodies, empty containers and garbage.

2. Permission must be obtained from the land owners to work in the streams crossing their property.

3. Stream bed material or bank material may not be removed under the pretext of debris removal.

4. All materials removed from the stream must be moved above the high water mark or disposed of in such a way so they will not re-enter the stream.

5. No heavy equipment such as bulldozers, tractors, back hoes or treefarmers will be allowed in the stream or on the banks to do the work. Fording when necessary will be made at preselected places by the supervisor. Material must be cabled or chained out of the stream bed by machinery or equipment stationed a minimum safe distance of 10 m from the immediate stream bank.

Logs and Windfalls

1. Remove all loose trees, logs or branches within the natural banks of the stream.

2. Remove all log jams or natural log dams through which the water passes.

3. A log firmly imbedded in the streambed and over which the flow passes should be left as shelter if the head is no greater than 0.30 m.

4. Uprooted trees securely fastened to the bank, and not blocking the main flow or more than ½ width between the natural banks should remain as shelter. In these cases, consideration should be given to erosion. If there is evidence of serious bank erosion or if the tree will be set free by erosion, the whole thing should be removed.

Trees

1. Badly damaged or dead trees which would fall into the stream should be removed. Trees containing nest cavities should be left.

2. Trees leaning over the water such that the main trunk is 30° or less from the water surface should be removed.

3. Branches from overhanging trees which would catch debris passing by in the stream should be trimmed appropriately.

4. Alders, weeds, or small trees growing on or within the stream banks should not be removed as they augment natural fish cover and contribute to food input from terrestrial insects.

5. It is important that as little of the forest canopy as possible be removed. A good general rule is "if in doubt, leave it".

Trash

1. All trash, car bodies, tires, tin cans, pop bottles, etc., should be removed and disposed of in the proper locations.

NOTE

Not all logs or tree root systems in a stream may be called debris. Often logs and roots are sheltering areas for trout and other species of fish.

COMMENTARY

Vegetation on watercourse banks is essential to reduce the erosion rate. Landowners are urged to maintain and encourage such stabilizing vegetation on all watercourse banks or to place artificial estabilization in problem areas. Agriculturists are urged to restrict livestock to one or two properly designed and protected stock watering access points. The cultivation of interval land within 10 metres of the bank is not considered good farming practice. Large trees along streams passing through crop or pasture land are not necessarily essential to protect the stream banks from erosion, but low-lying vegetation in a narrow strip should be allowed to grow.

Mature or overmature timber should be selectively cut over several years to allow replacement of vegetation in gaps created by each selective cut, and to maintain as much continuity as possible of a protective cover against erosion. Clearcutting of watercourse edges should not be done.

The above recommendations, if followed, should reduce erosion and stream meandering problems, and not seriously interfere with agricultural or recreational uses. In fact, the recreational use and that of downstream water users should be improved.

TYPE: Tree and Brush Removal with 10 metres of the Bank (2D)

REVISED: March 1984

GUIDELINES FOR TREE AND BRUSH REMOVAL WITHIN 10 METRES OF THE BANK

1. Vegetation must be maintained along the bank of a watercourse in sufficient quantity to:

(i) maintain the stability of the banks (unless erosion control measures are to be adopted); and

(ii) to provide adequate shade to prevent a rise of water temperature which would have adverse effects on fish, fish food and fish habitat.

2. Trees should not be felled across a watercourse. Tree farmers, skidders and other heavy machinery must not enter the 10 metre bank zone since maintaining the stability of the bank is of primary importance.

3. Slash and bark must be removed from the bank of the watercourse so as not to enter the watercourse during periods of high flow.

4. Grappling, bucking and winching and manual methods are preferred methods of removing trees and brush from the 10 metre bank zone.

5. Mowing and similar vegetation maintenance work in ditches and canals is exempted from these Regulations and guidelines by Section 3(4)(e) of the Regulations.

COMMENTARY

Vegetation on watercourse banks is essential to reduce the erosion rate. Landowners are urged to maintain and encourage such stabilizing vegetation on all watercourse banks or to place artificial stabilization in problem areas. Agriculturists are urged to restrict livestock to one or two properly designed and protected stock watering access points. The cultivation of interval land within 10 metres of the bank is not considered good farming practice. Large trees along streams passing through crop or pasture land are not necessarily essential to protect the stream banks from erosion, but low-lying vegetation in a narrow strip should be allowed to grow.

Mature or overmature timber should be selectively cut over several years to allow replacement of vegetation in gaps created by each selective cut, and to maintain as much continuity as possible of a protective cover against erosion. Clearcutting of watercourse edges should not be done.

The above recommendations, if followed, should reduce erosion and stream meandering problems, and not seriously interfere with agricultural or recreational uses. In fact, the recreational use and that of downstream water users should be improved.

TYPE: Landing Stages (Yards) (2E)

REVISED: March 1984

GUIDELINES FOR LANDING STAGES (YARDS)

1. Streamside or lakeside yardings are not permitted within 10 metres of a watercourse.

2. Landing stages should have adequate space for debris disposal and/or waste treatment.

3. Site rehabilitation should include replacing the top soil and sloping the land to that of the original terrain to allow for natural or artificial regeneration.

COMMENTARY

The objective of these guidelines is to avoid the denuding of stream or lake banks, to eliminate the chance of staged material entering watercourses and to reduce the erosion potential of such landing stages. In years past log driving stages were necessarily built on flooded land but now this practice is seldom necessary.

Wood or other organic material waste deposited in watercourses in addition to being unsightly, can seriously reduce aquatic production or survival by:

1. reducing the available dissolved oxygen during decomposition.

2. physically smothering young fish, fish eggs or other aquatic life.

3. destroying aquatic habitat for use by desirable organisims for long time periods, due to its slow decomposition rate; also, wood and other organic material causes water quality problems for domestic or industrial users.

Toxic material storage sites should never be located where flooding is possible due to the rise of water from high flows in a neighboring watercourse.

TYPE: Fords (2E)

REVISED: April 1977

GUIDELINES FOR FORDS

1. Watercourse crossing by vehicles or any sort is not recommended where the bottom material is composed of gravel or smaller material or where the watercourse banks are steep.

2. Watercourse crossing approaches should be as near a right angle to the watercourse as possible to minimize bank distrubance.

GUIDELINES FOR CONSTRUCTION OF TEMPORARY FORDS

1. Large clean non-orebearing rock material of baseball to basketball size or larger is recommended. Angular rock will stabilize better than other shapes.

2. The rock material should be obtained from a dry land source.

3. Approaches and stream crossing areas should be kept to a minimum consistant with safe use.

4. Temporary fords must have water overtopping the structure to a minimum of 6 ins. depth at all times, such that fish may move freely up or downstream. Should a drop in water level be anticipated (or occur) which would prevent fish passage, then either (a) an acceptably large culvert (min 30" dia.) be installed or (b) a portion of the ford material must be removed (possibly in a gently sloping "V" such that the reduced flow is passing over the center of the ford to a minimum of six ins. depth).

5. Immediately after essential use (three weeks or sooner) the rock material must be removed from the watercourse.

6. The approaches to the temproary ford should be restored to as near pre-construction condition as possible. If fine material is left exposed by approach material, rip-rap, sod or seeding should be used to avoid erosion.

7. Final instream clean up should be done by hand.

8. Temporary fords should not be in place for a period longer than three weeks. Temporary ford construction and use should be limited to the June to mid Sept. period.

COMMENTARY

Fords exist where a watercourse is shallow enough to allow it to be crossed by wading or where a watercourse has a bed firm enough and water shallow enough to permit vehicle crossing.

These guidelines are designed to minimize or eliminate unnecessary channel disturbance and damage to the aquatic habitat and at the same time permit essential works to be done in a reasonably efficient manner.

The constraints imposed are intended to eliminate avoidable quantities of sediments from entering the watercourse. Fording over the fine material watercourse beds by vehicles causes excessive cutting of the watercourse bed. Each crossing may result in a further deposition of silt in downstream areas with serious consequences to aquatic life.

The use of fords in commercial operation including, but not limited to, wood product removal, mineral transport or for extended construction purpose, is not recommended.

The new bridge construction with no reasonable access to the opposite shore, such access can be accomplished, where feasible, by a properly constructed temporary ford-where no solid rock bottom natural ford exists.

Properly installed temporary bridges or culverts are recommended where crossings are required for periods longer than three weeks. Permanent stream crossings should be installed where continuing use of roads is anticipated.

Temporary fords left after use without restoration can block fish migration at low stream flows and can eventually become dams by debris collection. Complete removal of temporary crossing materials are required as per general guidelines, when their use is no longer required. Banks left unrestored erode with serious consequences to downstream aquatic life as well as potentially causing new watercourse channels to develop.

In summary, it is important to design fords in order to prevent unnecessary damage to the environment, especially aquatic life.

TYPE: Beaches (2E)

REVISED: March 1984

GUIDELINES FOR BEACHES

1. Beach construction projects receiving approval must be constructed with clean sand and gravel only, and shall be protected where required by suitable erosion control works.
2. The source from which the beach material will be obtained as well as an analysis of the material shall be submitted with the application.

NOTE

Applications for beach construction will be assessed on a site specific basis, considering the following:

(a) Whether construction is planned above or below the normal water level.

(b) Type and stability of stream or lake bottom material.

(c) Extent or current shoreline development.

(d) Species of fish and/or wildlife which may utilize the shoreline during some stage of their life cycle.

(e) Timing of construction.

(f) Hydraulic conditions (e.g. floods, ice damage, draw downs, etc.)

COMMENTARY

The construction of artificial recreational beaches is a form of filling a watercourse. Flood storage and ice damage must be considered in design as well as the stability of the beach under the hydraulic conditions present.

Attempts at construction of a sand beach, where none exists naturally after thousands of years of non-human alteration, is unlikely to succeed. In fact, yearly replenishment of sand probably will be necessary.

Environmental Considerations

The shallow water areas in lakes or rivers are the areas of highest food production. Through complex food chains virtually all organisms are dependent upon these high production areas. It is a fact that rocky shores or shallow weedy mud bottomed areas are the most productive shorelines. Therefore, if rocky or mud bottomed areas are changed to sandy beaches, the area becomes akin to a desert.

If carried far enough, the creation of beaches may alter the nature of the water's animal and plant life to the extent that the original attractiveness of the water area is lost to the recreationist. Certain fish, waterfowl, or vital food organisms may no longer be present.

For the above stated reasons, construction of artificial beaches on inland waters is not recommended.

TYPE: Instrument Pools and Wells (2F)

REVISED: April 1977

GUIDELINES FOR INSTRUMENT POOLS AND WELLS

1. If located within 10 metres of the bank of a watercourse the instrument pool or well must be secured or protected from ice and other debris in the flow.

NOTE

Instrument pools or wells are constructed to support the operation of scientific equipment.

TYPE: Pipeline Crossing (Major & Minor) (2F)

REVISED: March 1984

GUIDELINES FOR PIPELINE CROSSING

1. During construction, streambanks may be graded up so that ground elevation gradually decreases from top of bank to edge of stream.

2. No heavy equipment should be used within 30 m of a stream prior to grubbing. Within the area, large trees and shrubs must be cleared manually.

3. Grubbing of the area within 30 m of the stream is permitted only when actual stream crossing work is to begin.

4. Grubbing may not be carried out beyond a 15 metre strip up and downstream of the crossing line (a total width of 30 m). As the work proceeds, all soil areas laid bare must be seeded and/or vegetated and the banks restored.

5. Pipe installed in a trench in an unconsolidated bed will be set two meters below the stream bed grade. If solid rock is encountered, which requires blasting, the pipe may be set at 1 meter below the stream grade. Exceptions to this condition may be stipulated in the watercourse alteration permit.

6. Any surplus material excavated from the stream bed or banks during trenching operations must be disposed of away from the stream.

7. Where rock was removed, gravel fill or clean quarried rock material may be used. Protective material will be placed on top of filled trench to prevent any possible erosion of materials beneath.

8. In wide stream crossings (major crossings) the pipe must be ballasted to prevent it from floating.

9. Appropriate environmental mitigation measures may vary in accordance to the trenching techniques employed and therefore crossings may be reviewed by regulatory and advisory agencies on a specific technique or case basis. Methods and detailed drawings will be required.

10. Where a major pipeline crosses a watercourse on supports or piers built especially to carry it, the guidelines for bridges apply.

11. A plan depicting erosion and sediment control methods will be required.

COMMENTARY

Occasionally it is necessary for pipelines carrying water, sewage, oil, etc. to cross streams along the pipeline route.

In the past, cases have been encountered where the pipe was laid on the bed of the watercourse creating total barriers to fish migration and susceptibility to damage from ice. Breakage of a line in the watercourse could cause pollutants such as sewage, oil, etc. to be discharged in the watercourse.

Pipelines should be arranged to cross under a watercourse by setting the grades properly. In some cases, an inverted siphon may be used. The pipeline must be placed below the expected limits of scour.

Alternately, pipelines can be placed high enough over a stream to prevent damage from floods and ice.

TYPE: Water Intake Structures (2F)

REVISED: March 1984

GUIDELINES FOR WATER INTAKE STRUCTURES

1. The water intake structure shall be constructed with bed and bank protection to adequately protect the watercourse and the intake works from local erosion.

2. The intake works should be designed so that the required water will be available to it without the need for ancillary structures or frequent channel maintenance.

GUIDELINES FOR A STATIONARY TYPE SCREEN AT WATER INTAKES TO PREVENT LOSSES TO JUVENILE SALMON AND TROUT

1. An open area of 0.19 m^2 (2.0 $ft.^2$) of screen shall be provided for each 0.028 m3/sec. (1.0 ft.3/sec) or 1710 1/min. of water diverted.

2. Screens are usually made up in panels constructed of a frame of steel angles or channels with the mesh stretched over the frame.

3. The screen shall have openings not less than three meshes per 25 mm.

4. The screen panel should fit snugly in the guides so that spaces larger than the clear opening in the mesh do not occur. A double set of guide slots positioned back to back should be provided. A spare screen is then slipped into the spare slots while the first panel is removed for maintenance.

5. To accommodate maintenance operations, a spare screen is required.

6. A trash rack shall be installed to protect screen panels from damage (i.e., logs). Normally the trash rack bar spacing used is 150 mm (approx 6 inches).

7. The screen shall be cleared of debris at regular intervals.

Screens with the above specifications are applicable to relatively small diversions. Large diversions, particularly surface diversions, present difficult cleaning problems and will generally require special consideration, perhaps involving a self-cleaning type screen.

COMMENTARY

It is necessary to screen water intakes so as to prevent the entry of fish and subsequent fish kills.

Sufficient screen area must be provided to ensure approach velocities are less than 0.15 m/sec. (0.5 ft./sec.) and velocity through the net screen area is not greater than 0.15 m/sec. (0.5 ft./sec.). This criteria shall take precedence over the specifications in the following sections.

The screen shall be cleaned of debris at regular intervals. Partial blockage of screens can cause undesirable high velocities through the screens in localized areas in the vicinity of clean patches.

Screens are usually made up of panels constructed of a frame of steel angles or channels with the fine mesh stretched across the inside and the coarse screen across the outside.

The screen panels should fit snugly in the guides so that spaces larger than the clear opening in the fine mesh do not occur. It is desirable to have a double set of guide slots back to back, for the screen panels. A spare screen panel is then provided which is slipped into the spare slot while the first panel is removed for cleaning and servicing. This will ensure protection to fish and the wet well at all times.

It is always good practice to have a trash rack of heavy steel installed to protect the screen panels from damage from larger debris such as logs. Normally the trash rack bar spacing used is 150 mm.

TYPE: Ponds, By-pass Variety (2G)

REVISED: March 1984

GUIDELINES FOR PONDS OF BY-PASS VARIETY

Design

1. The minimum distance from the pond to the watercourse shall be fifteen metres as measured from top of bank to top of bank.
2. The site of the pond shall be chosen such that the natural drainage to the pond does not include known sources of pollution.
3. The maximum water withdrawal rate per pond from the watercourse shall not exceed one third (1/3) of the low flow for the site as computed by the formula:

   $Q = 0.00055\ m^3/s/km^2 \times A\ km^2$

   $Q = 0.05\ cfs/mi^2 \times A\ mi^2$

   where

   Q = the low flow of the watercourse
   A = the catchment area
4. The inlet and outlet of the by-pass pond must be screened as follows:
   - (i) inlet - screened on streamside. An outside screen of larger mesh or a trash rack must protect the inner screen.
   - (ii) outlet - screened on pond side.
   - (iii) mesh size of screens are per Water Intake Structures Guidelines.
5. The inlet and outlet must be protected from the action of the stream.

NOTE

Any dyke or berm located around a pond must be constructed according to other appropriate guidelines.

Construction

1. Trees and brush must be removed and disposed of away from the site of the proposed pond.

COMMENTARY

The advice of a specialist should be taken before the construction of a by-pass pond begins. Highly permeable soils and small catchments should be avoided.

Care should be exercised in the selection of the size so that the area will not suffer flood damage in high run-off periods.

This type of pond should be located on gently sloping areas which have no well-defined channels or gullies.

Where possible to augment flow to a by-pass pond by interpreting springs or the land slope of the area this is adviseable. Generally, for high water quality in the pond it is adviseable to design a small pond relative to the water supply.

TYPE: Farm Ponds of the Dugout Variety (2G)

REVISED: November 1976

GUIDELINES FOR FARM PONDS OF THE DUGOUT VARIETY

Design

1. The minimum distance from the pond to the watercourse shall be fifteen metres.

2. The site of the pond shall be chosen such that the drainage area to the pond does not include barnyards, feeding lots, and similar sources of pollution.

3. The minimum slope of the side of the dugout shall be two horizontal to one vertical.

4. The minimum average depth of a dugout pond shall be one metre (39 inches).

5. The pond site must be in non-porous subsoil or the pond sealed to prevent water seepage loss.

Construction

1. The pond shall be fenced to control access by livestock and people.

2. The site shall be cleared of all brush, roots, sod and loose topsoil. Ponds for fire protection must be accessible by all weather roads.

COMMENTARY

Ponds in this category are used on farms and in rural areas for the following: irrigation, domestic water supply, livestock watering, fire protection, rearing of fish, recreation, or wildlife.

Care must be taken in the selection of a site to ensure a constant water supply for its use. Examples of locations: low wet areas, springs, and side hill seepage areas. Design assistance is available to farmers through the Engineering Branch, N.B. Department of Agriculture.

If fish are to be kept in the pond, prior permission must be obtained from the Department of Natural Resources and Energy, Fish and Wildlife Branch.

TYPE: Pool Restoration (2H)

REVISED: November, 1984

GUIDELINES FOR POOL RESTORATION

1. The upper and lower most limits of the pool must be delineated by permanent land based bench marks such as a survey metal stake prior to restoration work.

2. The pool must be restored in one day, by one piece of machinery.

3. The long axis of the pool must lie along the direction of flow in the stream.

4. The size of the pool shall not exceed its original dimension and the restoration work should be carried out only to achieve this goal.

5. Instream work must cease immediately in the event that unconsolidated materials including but not limited to; mud, clay, organic material, etc., is exposed during excavation activities. If this situation occurs, the Proponent must immediately backfill the excavated area with pool spoil to prevent the leaching of such undesirable material into the water column.

6. The stream bank must not be under-cut along the extent of the pool/bank interface. The shoreline must remain intact and untouched except at the entry and spoil removal point which must be stabilized after the completion of the work.

7. Established shoreline vegetation including but not limited to grasses, rushes, shrubs and trees must not be removed or disturbed during restoration work.

8. If access is not already available at the pool, equipment must enter the watercourse at a stable shoreline location downstream, as close as possible to the lowermost limit of the pool.

9. Spoil from the pool may be stock piled at the lower limit of the pool until the excavation is complete; the spoil pile must then be removed from the watercourse along the original line and point of entry of the equipment into the water and spread evenly along the downstream shoreline below the high water line.

10. The Water Resource Planning Branch of the New Brunswick Department of Municipal Affairs and Environment (453-2353) must be notified 5 days prior to the commencement of the project so that a day for actual construction can be scheduled.

11. The pools must be restored as specified on the Watercourse Alteration Permit. A representative of the N.B. Department of Municipal Affairs and Environment will be on site to advise on unforeseen circumstances.

COMMENTARY:

Restoration of fish holding or angling pools in the Province of New Brunswick may be authorized when the Proponent of such an undertaking has demonstrated that a former "pool" has been destroyed or has changed significantly from it's original dimensions and properties.

Restoration of pools which may adversely affect fisheries resources, fish habitat and the hydrological and geophysical properties of the watercourse will not be authorized.

The existence of a pool or former pool must be substantiated by:

(a) Providing historical records such as photographs, drawings plans and sketches of the pool and/or making reference to previous restoration permits.

(b) Specifying the original and present pool dimensions in terms of length, width and water depth and providing cross-sectional river profiles at the pool location.

The restoration of existing fish holding or angling pools may be authorized when it has been determined through a formal application review and project assessment process that the proposed undertaking is environmentally acceptable and meets all applicational requirements.

The restoration of pools which require frequent maintenance may be restricted or discontinued. The frequency of pool restoration will depend upon many factors including but not limited to pool design and configuration, physical pool characteristics and properties, magnitude and frequency of major hydrological events, etc. Pools which require restoration annually, or every second year, and which have not been affected by major hydrological events, will be regarded as unstable and not compatible with the watercourse. Restoration of such pools will not be permitted.

Pools which are destroyed, changed or rendered non-functional by major hydrological or climate events will be subject to re-application, review and assessment.

The number of pools which may be restored in a given watercourse expanse will be limited and determined on the basis of the ecological features and the physical characteristics of the watercourse.

Tracked vehicles such as bulldozers and excavators may be permitted for instream work. The equipment must be operationally reliable, clean and free of grease, oil, lubricants and other deleterious materials and substances.

The use of explosives as a means of excavation is not acceptable.

The installation of boulders within salmon pools has been found to enhance their stability. Boulder grouping, using rocks 1.0 metre or more in size, stratigically placed within the pool at a spacing of 2 - 3 metres will minimize bedload deposition in the pool. These rock grouping installations require minimum maintenance because minor movements of individual rocks do not seriously reduce the installation's effectiveness. It is therefore recommended that rock installations be carried out during the restoration process.

TYPE: Rock Placement (2H)

REVISED: April 1977

GUIDELINES FOR ROCK PLACEMENT

1. Rock placed in a watercourse must be clean and non-orebearing stone.

2. The minimum sized stone should be 18" in diameter; or roughly oval or rectangular in shape with the smallest dimension being 15". The size of the stones will depend on the hydraulic forces in the watercourse. Stones should be stable when placed.

3. The placement of rocks in a watercourse shall be done so as to cause no interference with ice passage or the passage of canoes and small watercraft.

NOTE

Rock placement shall not be allowed in recognized navigable waterways unless approval is first obtained from the Ministry of Transport. The work shall be sanctioned and supervised by the Federal and Provincial Fisheries agencies.

COMMENTARY

Rock placement in watercourses is generally done in an attempt to improve the holding ability of salmon pools or to create new pools. There are only certain, not well-defined situations, under which rock placement will meet the objective of holding salmon.

TYPE: Pool Creation (2H)

REVISED: February 1977

GUIDELINES FOR POOL CREATION

There are no specific guidelines for the creation of fish holding pools as this is a restricted activity. See the general guidelines.

NOTE

The creation of a fish holding pool will not be allowed in recognized angling streams, except when the purpose is for habitat improvements and the work is sanctioned and supervised by the Federal and Provincial Fisheries agencies.

COMMENTARY

Pool creation is generally done to improve the resting and rearing habitat of a watercourse for sport fishing purposes. However, most N.B. watercourses have a well balanced system of pools and riffles which requires little improvement. There are only a few situations where stable pools can be created to benefit the fishery.

TYPE: Erosion Control Works (3A)

REVISED: April 1977

GUIDELINES FOR EROSION CONTROL WORKS

1. Erosion control works shall be placed along the bank of the watercourse in such a manner as will keep encroachment into the main channel to a minimum. Note the Guidelines on Constrictions.

2. Foundations of erosion control works shall be designed so that there will be no embankment failures. The possible scour depth below the protective works should be evaluated.

3. The material used for erosion control works must not come from the bed of the watercourse and should be clean, non-ore-bearing and non-toxic. Necessary filter layers should be incorporated to prevent loss of fine material. Some materials used in erosion control are:

Good grass/ sod cover
Rock filled wire baskets and/or timber cribs
Rip-rap
Concrete blocks of various shapes
Wood, concrete and steel linings
Stone (sloped and graded as per design)
Filter cloths

4. Erosion control works should be designed to withstand water forces from buoyancy, high velocity, wave action. The forces due to ice movement must also be evaluated in the design.

5. Construction should be accomplished in July, August or September whenever possible and in a manner planned to keep sediment loss from the work site to a minimum

COMMENTARY

Erosion control works are often necessary to prevent the loss of property and damage to roads, buildings and valuable land, etc. Often stabilizing of watercourses subject to frequent meander changes is the reason for constructing erosion control works.

Many techniques are used for controlling erosion such as rock placement, retaining walls and jetties. In the Maritimes the most common method is a rock slope protection. For this type of erosion control, the design should be carried out using the extensive literature on the subject so the proper size/s and slope can be determined. An example of literature relating to this subject is Chapter 5 of the "Guide to Bridge Hyraulics", edited by C.R. Neill.

Table 5.1 below is reproduced from this reference as an example of design charts available.

TABLE 5.1 SUGGESTED STONE RIP-RAP GRADINGS FOR STREAM BANK REVETMENT*

Class 1

Nominal 12 inch diameter or 80 lb weight
Allowable local velocity up to 10 ft/sec
Grading specification:

	100% smaller than 18 inches or	300 lb
at least	20% larger than 14 inches or	150 lb
at least	50% larger than 12 inches or	80 lb
at least	80% larger than 8 inches or	25 lb

Class 11

Nominal 20 inch diameter or 400 lb weight
Allowable local velocity up to 13 ft/sec
Grading specification:

	100% smaller than 30 inches or	1500 lb
at least	20% larger than 24 inches or	700 lb
at least	50% larger than 20 inches or	400 lb
at least	80% larger than 12 inches or	70 lb

Class 111

Nominal 30 inch diameter or 1500 lb weight
Allowable local velocity up to 15 ft/sec
Grading specification:

	100% smaller than 48 inches or	5000 lb
at least	20% larger than 36 inches or	2500 lb
at least	50% larger than 30 inches or	1500 lb
at least	80% larger than 20 inches or	400 lb

*Note the percentages quoted are by weight; the sizes quoted are equivalent spherical diameters,

= 1.24 volume;

the relative density is assumed to be in the range 2.4 to 2.9 (for a size-weight conversion chart see Figure 5.5).

SOURCE: Guide to Bridge Hyraulics, ed. C.R. Neill,
Published by the Roads and Transportation Assoc.
of Canada by the University of Toronto Press,
Toronto: 1973, p. 120

Frequently the other types of erosion control works should be designed by a Professional Engineer familiar with this category of projects.

Of the many sources of information available on erosion control the handbook type produced by several soil conservation and transportation agencies provide ready graphic information which is recommended as a first source of guidance when preparing proposals.

TYPE: Floodwater Diversion Channels (Floodways) (3B)

REVISED: October 1976

GUIDELINES FOR FLOODWATER DIVERSION CHANNELS

1. The hydraulic gradeline of the floodwater diversion shall tie into the elevation of water in the outlet expected for the frequency storm selected for design.

2. The bed slope of the floodwater diversion channel shall be in the direction of flow and shall not result in a velocity that will cause excessive erosion or sedimentation.

3. The design capacity of the floodwater diversion channel shall be chosen in regards to the desired level of protection.

Outside of flood periods, there must be no diversion of water from the watercourse through the floodwater diversion channel.

4. The bed of the floodwater diversion channel sahll not contain depressions which could trap water and/or fish once the flood is over.

COMMENTARY

This construction of floodways has not been common in New Brunswick. Much of the success of a floodway depends upon soil conditions topography and flood characteristics. A completed floodway may give the owner(s) of flood plain property a greater sense of protection than actually provided by the floodway. For these reasons, all floodways should be designed only by a person licenced to practice as a Professional Engineer and who is experienced in hydrotechnical design.

TYPE: Flood Protection Works (3B)

REVISED: April 1977

NOTE

Specific guidelines have not been developed for flood protection works since this type usually consists of a combination of measures which differ from the previously listed types of alterations only in the purpose that they serve. As such, a combination of measures proposed as a scheme to provide flood protection could be presented within the "Factor in Common" required for a multiple permit application.

In preparing a proposal to conform with these guidelines please refer to the individual guidelines for each specific alteration type as part of the scheme.

TYPE: Removal of Major Obstructions (those listed in 1A to 1C inclusive) (4A)

REVISED: June 1976

GUIDELINES FOR REMOVAL OF MAJOR OBSTRUCTIONS

1. A procedure for the removal of hydraulic structures that impound water shall be such that there be only gradual changes in the upstream and downstream water levels.

2. Structures should be removed to the bed level of the watercourse where possible. If the remnants of the structure poses a threat or a potential threat to navigation, then arrangements must be made with the Ministry of Transport to identify the hazard, during and after removal.

3. All blasting operations must be done under the supervision of a Fisheries Officer from Fisheries and Oceans Canada.

4. The need for site restoration work upstream of the obstruction which is to be removed (i.e. old pond areas, etc.) should be considered since site cleanup measures may be required of the permittee.

COMMENTARY

A major obstruction should only be removed where the benefits of removal exceed the cumulative effects of any resulting environmental problems. It should be remembered that the removal of an obstruction to solve one problem, such as a barrier to fish migration, might create other problems such as an aesthetic depreciation of an area. Planning for the removal of a major obstruction must not only involve the choice of machinery and the scheduling of manpower but also analysis of the positive and negative effects of the removal on the environment.

TYPE: Removal of Minor Obstructions and Alterations (4B)

REVISED: April 1977

GUIDELINES FOR REMOVAL OF MINOR OBSTRUCTIONS AND ALTERATIONS

1. The channel shall be restored, as near as possible, to its original cross-section. The removal and channel restoration shall be limited to the minimum work area necessary.

2. After the removal is complete the work area and any disturbed soil banks or slopes shall be stabilized to prevent erosion. Refer to the Guidelines for Erosion Control.

3. All material related to the removal and any debris brought to the work area shall be disposed of in a manner so it will not be returned to the watercourse.

4. This type of work should be done during July, August or September.

COMMENTARY

In general, minor obstructions and alterations to the natural environment should not have to be removed except in the case of temporary bridge or culvert crossings. The removal of other minor obstructions should be justified by outlining the need for removing the works.

TYPE: Removal of Protective Works (4B)

REVISED: April 1977

GUIDELINES FOR THE REMOVAL OF PROTECTIVE WORKS

1. The channel shall be restored, as near as possible, to its original cross-section. The removal and channel restoration shall be limited to the minimum work area necessary.

2. After the removal is complete the work area and any disturbed soil banks or slopes shall be stabilized to prevent erosion. Refer to the Guidelines for Erosion Control.

3. All material related to the removal and any debris brought to the work area shall be disposed of in a manner so it will not be returned to the watercourse.

COMMENTARY

It is expected that protective works would rarely be removed unless in the cases where the measure of protection was no longer required or reconstruction was required. The reason for the removal should be carefully documented on the application.

TYPE: Drainage of Lakes, Swamps, Wetlands (5A)

REVISED: March 1984

GUIDELINES FOR DRAINAGE OF LAKES, SWAMPS, WETLANDS

1. Proposals for the draining of lakes, swamps or wetlands will be assessed on a site specific basis.
2. The possible effect of drainage on a neighboring water supply may be required as a supporting evaluation prior to project approval, at the proponent's expense.
3. Proposals to drain a lake, swamp or wetland will be considered if the proponent owns all the land surrounding the lake or swamp, or has a written agreement with the landowner(s).

NOTE

In this Section swamp is interpreted to include swamps, bogans, bogs, marshes, wetlands and backwater.

COMMENTARY

The Lakes, Swamps and Wetlands of New Brunswick form an integral part of the natural water supply of streams and groundwater. Drainage of these areas disrupts the runoff and recharge patterns. Although drainage can be helpful to the use of the land area for some purpose it may also cause serious disbenefits to a water supply or worsen flooding conditions downstream.

Wildlife requires water of sufficient quality and quantity (a) to maintain their health; and (b) to provide a productive environment.

Wetlands form a major part of our ecosystem. With respect to fish and aquatic ecosystems in general, water is required in sufficient quantity and acceptable quality to maintain the aquatic environment in a dynamic but balanced state. It is important to bear in mind that fish form an essential part of the diet of many other species of land based and aquatic animals and the maintenance of a healthy fish population, whether in general or of a particular species, may react equally, if indirectly, to the detriment of other dependent species.

TYPE: Miscellaneous Drainage Changes (5B)

REVISED: May 1977

GUIDELINES FOR MISCELLANEOUS DRAINAGE CHANGES

1. Highway, railway and agricultural ditches are exempted from the permit requirements under the Watercourse Alteration Regulation, for construction and maintenance, provided that there is no resulting "danger of pollution".

2. Open ditches must be provided with stable boundaries by means of design adjustments in the hydraulic elements to suit the material (soil) being ditched or else by erosion control measures.

3. Outflow discharge from drainage works should be carefully located to avoid causing damage and conform with any by-law of local authority. Whenever possible the control of increased runoff due to changes in land use must be accomplished within the area being drained or serviced.

COMMENTARY

Miscellaneous drainage changes are intended here to comprise those minor adjustments to the drainage pattern of an area which are necessary to allow surplus runoff to be handled without problems and to aid in development of a land area. The common complication which arises is that the cumulative effect of many minor changes may be a major change in the drainage pattern of a large area. When a development of several acres is palnned it is often cost effective to undertake a Storm Water Management analysis to plan the facilities for handling runoff water. Such planning will minimize costs on site and downstream. On site facilities such as temporary storage retention ponds are often suggested as part of the solution in an area drainage control plan.

In agricultural areas drainage control should follow an accepted code of agricultural practice and be part of the total farm plan.

Since drainage works take up a certain amount of land area it may be important to insure that easements or rights-of-way are provided. Miscellaneous drainage changes carried out on single residential lots are considered minor in the overall context and since they involve alleviating a nuisance to the homeowner, they will not be subject to the enforcement of the Regulations provided that they are carried out within the spirit and letter of these Guidelines.

TYPE: Subdivisions and Alignments (5C)

REVISED: March 1984

GUIDELINES FOR SUBDIVISIONS AND ALIGNMENTS

1. These guidelines are intended for proposals having a direct effect upon a watercourse. However, the following items will also be considered for developments adjacent to but not necessarily directly altering a watercourse if requests to have the plans reviewed are made by other departments or agencies.

2. Plans shall be provided indicating the type of development limits of the project, proposed siting layout, existing topography, and change in ground cover.

3. A written description associated with a sketch or plan describing erosion and sediment control methods and locations to be incorporated during both the construction and post construction stages of the project shall be provided.

COMMENTARY

The purpose of this guideline is to allow for orderly planned development in a way that permits the maximum utilization of land with a minimal amount of physical environmental impact.

Developments in excess of two hectares, which have their drainage networks designed by a registered Professional Engineer rather than using the standard drainage structure dimensions as described in other sections of the "Watercourse Alterations Technical Guidelines", shall have the Engineer submit calculations showing method of flow predictions, a summary of assumptions made and the impact or restrictions placed on future upstream developments.

The erosion and sediment control plan must depict a strategy for preventing sediment discharge from disturbed areas during each phase of construction. Sediment discharge potential can be greatest during the early grading phases prior to ditch and slope stabilization and the routing of surface water flows into inlets, pipes and ditches. Not only must an overall strategy be presented, but the strategy must be portrayed. Plans must provide continuous control that is integrated with the sequence of construction necessary to build the facility. Also, sufficient and clearly stated instructions must be presented so that field personnel can properly pursue the requirements and intent of the plan.

CHAPTER 4

4. LEGISLATED PROJECT CONSTRAINTS

Legislated project constraints are those restrictions on the design or construction or the carrying out of a watercourse alteration by specific clauses in various Acts and Regulations of the Legislature of New Brunswick and the Parliament of Canada.

4.1 NEW BRUNSWICK CLEAN ENVIRONMENT ACT WATERCOURSE ALTERATION REGULATION

The main piece of legislation for the control of watercourse alterations and the operation of the Watercourse Alteration program is the Watercourse Alteration Regulation, Regulation 82-233 under the New Brunswick Clean Environment Act, Chapter C-6 of the Revised Statutes of the Province of New Brunswick. It is administered by the New Brunswick Department of Municipal Affairs and Environment.

The requirement that a permit be obtained before commencing a project is stated in subsection 3(1):

> "3(1)...No person shall commence, make or carry, out any watercourse alteration or cause any watercourse alteration to be commenced, made or carried out unless that person is authorized to do so by a permit issued by the Minister."

Due to the damage caused to the fishery resource and the resulting possible damage from upsetting the river regime, the large scale removal of bed and bank material from a watercourse is not permitted. Section 4 of the Watercourse Alteration Regulation states:

> "4..... Notwithstanding any provision of this Regulation, no person shall remove or cause the removal of

> sand, gravel rock or similar material from a watercourse for sale, gain or commercial use or for the purpose of processing or manufacturing such sand, gravel, rock or similar material into another product."

Sale refers to any financial or barter transaction in which the sand, gravel or rock is removed from the watercourse and transferred as property to another individual. Commercial use refers to the production of concrete or another manufactured material using the sand, gravel, rock and similar material removed from the watercourse as a principal ingredient. Please note that this subsection is not a complete ban on gravel removal from a watercourse.

4.2. NEW BRUNSWICK FISH AND WILDLIFE ACT

The Department of Natural Resources and Energy of the Province of New Brunswick as represented by the Minister of Natural Resources and Energy and the Director of the Fish and Wildlife Branch has the responsibility for the administration and enforcement of the Fish and Wildlife Act (N.B.)

The N.B. Fish and Wildlife Act authorizes the appointment of Deputy Game Wardens and Special Game Wardens who are responsible for the enforcement of the Fish and Wildlife Act, the Fisheries Act & Fire Act. Deputy Wardens may also be ex-officio officers under the Canada Fisheries Act and the Migratory Bird Convention Act.

Stream Alteration responsibilities of the Department of Natural Resources and Energy arise from legislation contained therein: The Revised Statutes of New Brunswick, 1973, Chapter F-15, Fisheries Act:-

"17 (4)... Everyone is guilty of an offence who without the approval of the Minister (of Natural Resources and Energy) alters or causes to be altered the configuration of the bed, bank or boundary of any river or stream, or alters or interferes in any manner with the quantity or direction of the flow of water in any such river or stream."

"17 (5)... Upon conviction of any person under the provisions of subsection (4) of this section, the Minister may order that the bed, bank or boundary of such river or stream be restored to as near as possible its original condition, and the cost of such restoration shall be borne by the person so convicted. R.S., c. 87, s.17; 1960-61, c. 43, s.1".

The Department of Natural Resources and Energy is, moreover, vitally concerned with damage or loss of fish and wildlife habitat or to water quality for human use. Natural Resources and Energy actively cooperates with the New Brunswick Department of Municipal Affairs and Environment in the watercourse alteration program to fulfill its legislative responsibilities and to assist in minimizing or eliminating damage to the aquatic environment.

4.3 CANADA FISHERIES ACT

It is a requirement to provide fish passage facilities at obstructions where the need is determined by the Minister of Fisheries under the authority of Canada Fisheries Act.

The Fisheries Act states in part the following:

"20. (1)...Every slide, dam or other obstruction across or in any stream where the Minister determines it to be necessary for the public interest that a fish-pass should exist, shall be provided by the owner or occupier with a durable and efficient fishway, or canal around the slide, dam or other obstruction, which shall be maintained in a good and effective condition by the owner or occupier, in such place and of such form and capacity as will in the opinion of the Minister satisfactorily permit the free passage of fish through the same;. . ."

Section 20 (2) covers construction of fishways and related matters pertaining to fish passage at manmade barriers on rivers and streams.

"20 (2)... The place, form and capacity of the fishway or canal to be constructed must be approved by the Minister before construction thereof is begun; and immediately after the fishway is completed and in operation the owner or occupier of any dam or obstruction shall make such changes and adjustments at his own cost as will in the opinion of the Minister be necessary for its efficient operation under actual working conditions, if such are found to be needed."

Not more than 1/3 of the stream width shall be blocked at one time. This degree of blockage is limited by Section 24.(1) of the Canada Fisheries Act which states:

"24 (1)... One third of the width of any river or stream, and not less than two-thirds of the width of the main channel at low tide, in every tidal stream shall be always left open and no kind of net or other fishing apparatus, logs, or any material of any kind shall be used or be placed therein."

For blasting operations, the Act provides legislative authority as follows:

> "26... No one shall hunt or kill fish or marine animals of any kind, other than porpoises, whales, walruses, sea lions and hair seals, by means of rockets, explosive materials, or explosive projectiles or shells. R.S., c. 119, s.26."

Section 30 of the Canada Fisheries Act provides for the protection of eggs or fry as follows:

> "30... The eggs or fry of fish on the spawning grounds, shall not at any time be destroyed. R.S., c. 119, s. 30."

The deposit of deleterious substances is covered by Section 33 of the Canada Fisheries Act as follows:

> "33 (2)... Subject to subsection (4) no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any condition where such deleterious substance or any other deleterious substance that results from the deposit of such deleterious substance may enter any such water."

> "33 (3)... No person engaging in logging, lumbering, land clearing or other operations, shall put or knowingly permit to be put, any slash, stumps or other debris into any water frequented by fish or that flows into such water, or on the ice over either such water, or at a place from which it is likely to be carried into either such water."

The Fishways Obstructions Removal Regulations are stated as follows:

> "2... Where the Minister of Fisheries for Canada is satisfied that any material or casual obstruction existing in any waters frequented by fish, whether navigable or non-navigable, is interfering or is likely to interfere with the free passage of fish, he may cause such obstruction to be released, removed or destroyed, in whole or in part, in such manner and by such means as he deems advisable."

Fisheries and Oceans Canada is prepared to provide engineering advice and assistance in the design and construction of fishways. Functional designs can be prepared for the owner when fish passage facilities are required. Under special arrangement, full services of design (including structural) and construction supervision may be possible.

Copies of the Canada Fisheries Act are available on request from Fisheries Protection Officers or directly from the Director General, Department of Environment, Fisheries Service, P. O. Box 550, Halifax, Nova Scotia, B3J 2S7.

In the planning of watercourse alterations applicatants should aquaint themselves with requirements under the Fisheries Act.

4.4 ENGINEERING PROFESSION ACT

The Engineering Profession Act, administered by the Association of Professional Engineers of New Brunswick, is intended to regulate and govern the profession of engineering to protect and serve the public interest. The Engineering Profession Act places restrictions on who can design engineering works and systems as stated on subsection

2(2) and 2(3):

"2 (2)... Without restricting the generality of the foregoing, the term "practice of engineering" within the intent of this Act, shall mean the provision of services for another as an employee or by contract; and such services shall include consultation, investigation, evaluation, planning, design, responsible supervision, management, research and development of engineering works and systems and the teaching of advanced level courses in any branch of engineering applicable to such works and systems but does not include services by other technical personnel whose work is being carried out under the ultimate responsibility of a professional engineer (engineer)."

"2 (3)... Without restricting the generality of the foregoing, engineering works and systems shall include:

(a) transportation systems and components related to air, water, land or outer space; movement of goods or people;

(b) works related to the location, improvement, control and utilization of natural resources;

(c) works and components of an electrical, mechanical, hydraulic, aeronautical, electronic, thermic, nuclear, metallurgical, geological or mining character and others dependent on the utilization of the application of chemical or physical principles;

(d) works related to the protection, control and improvement of the environment including those of pollution control, abatement and/or treatment;

(e) the structural, electrical, mechanical, communications, transportation and other utility aspects of building components and systems;

(f) structures and enclosures accessory to engineering works and intended to support and/or house them."

Drawings relating to engineering works shall be marked with the seal of a Professional Engineer as stated in subsection 9(4):

"9 (4)... No person shall use drawings, plans and documents pertaining to engineering works in the Province except where the same have affixed thereto the seal of a member or licensee."

NOTE: Permits for Watercourse Alterations may be refused for non-compliance with the Above Acts. It is the applicant's responsibility to ensure compliance with the above Acts, and any other applicable Acts of the Legislature of New Brunswick or the Parliament of Canada.

CHAPTER 5

5. FISHERY CONCERNS

5.1 TIMING OF INSTREAM WORK PROJECTS

Any works carried on in the streams, particularly with heavy machinery, may have adverse effects on the fish resources of these streams, as well as on the utilization of these resources by the fishing public. By judicious timing of such instream works, these adverse effects may be reduced. Rarely can any instream work with heavy machinery be regarded as harmless. Gererally speaking, the adverse effects of heavy instream works occur in a variety of ways but some of the more significant are obstruction of the streams during the spawning migration of anadromous fish species, particularly salmon and trout and to a lesser extent gaspereau, shad, smelt and in a few areas brown and rainbow trout; heavy silting of spawning beds after egg deposition; injurious effects of excessive silting on resident populations of trout and juvenile Atlantic salmon, particularly during the low water - high temperature periods; filling in of established trout and salmon pools; and the destruction of aquatic invertebrates.

Timing of Works

Adult salmon runs into the main Saint John River and the main Miramichi River occur in May, peak in June and July, slack off in August, peaking slightly again in September to mid-October. In the Restigouche River, the run starts after mid-May, peaking the latter part of June with nothing much occurring in August and no pronounced late run. There are tributaries to these streams which salmon do not ascend very far until fall - there are exceptions however -

Rocky Brook and the Nashwaak are notable exceptions but not the only ones.

Speckled trout and brown trout (where they occur in the Maritimes) have several runs moving both in and out of fresh water during early spring and summer and in the fall.

Equally important to maintenance of our trout and salmon resources are the stream residents of both species. As indicated earlier, both juvenile salmon and resident trout are vulnerable to adverse changes in the water quality and loss of food fauna.

From this, it is obvious that the degree of damage caused by instream works depends not only on the extent and nature of the instream work but also on stream conditions. There is no rule of thumb which allows selection of "best times" for specific instream work projects. Maximum protection for trout, salmon and to some extent juvenile gaspereau appears likely if works are carried on during low summer flows and these are in general more prevalent during the July - August period in the Maritimes. Extensive instream work can be permitted from the end of June to the end of September in many cases but sufficient lead time should be allowed to permit adequate assessment of such proposals.

Brown trout populations are not extensive in the Maritimes but where they exist, instream works should be subject to the same general restraints as that for salmon and speckled trout.

Other Anadromous Species which enter Maritime Streams

Shad enter fresh water about the same time as gaspereau but generally do not ascent as far. In general, their progeny leave the fresh water earlier than gaspereau but they may be found in late summer.

Bass move into fresh water in early spring through June. Their progeny may remain in fresh water as late as August and September.

Smelts may enter from estuaries in early April and spawn near the head of tide in main streams or in tidal branch streams. Their progeny are carried, as fry, down into brackish water soon after hatching.

5.2 FISH CONSERVATION WORKS

Fishways

Section 20 of the Fisheries Act covers construction of fishways and related matters pertaining to fish passage at manmade barriers on rivers and streams.

> "20 (2)... The place, form and capacity of the fishway or canal to be constructed must be approved by the Minister before construction thereof is begun; and immediately after the fishway is completed and in operation the owner or occupier of any dam or obstruction shall make such changes and adjustments at his own cost as will in the opinion of the Minister be necessary for its efficient operation under actual working conditions, if such are found to be needed."

The Resource Development Branch, of the Department of Fisheries and Oceans, Canada provides engineering advice and assistance in the functional design of fishways.

Upstream Passage

Three types of fishways are commonly used in the Maritime Region. These are pool and weir, vertical slot and Denil or steep pass types.

The pool and weir has been the most popular because it uses less water, but it cannot tolerate large head pond fluctuations, and is more natural than the other types. A flow of 5 to 10 cfs is usually laid on a slope of 1:8 or 1:10 and sometimes 1:6.

Vertical slot fishways require more water than the other types, normally in the order of 20 cfs. Slot widths are normally 12" or 9". This type is useful in tidal locations where large fluctuations occur in headpond or downstream water levels. Slope of 1:8 or 1:10.

The Denil or steep pass fishway is becoming more popular because it is less costly due to its smaller physical size and it can be readily prefabricated. Notch widths are 12" or 18" and overall width 2 1/2' and 3'; a slope of 1.6 is recommended. However, they are limited in length to about 50 to 60 feet. Slopes from 1:6 to 1:4.5. However, water consumption can be high.

Construction materials can be concrete, treated timber or fiberglass, and other materials or combinations are being considered for Denil fishways.

Maintenance and proper operation of fishways is the responsibility of the owner. However, to insure efficient use of facilities, at the nearly 100 existing fishway sites, it is necessary for Resource Branch field personnel in these specific areas to regularly inspect flow conditions and fish movements during the various migration periods.

Downstream Passage

The movement downstream of juvenile fish and spent adults is sometimes overlooked at dam sites especially during periods of low flow or at hydroelectric power stations.

If a fishway exit is conveniently located at the manmade barrier migration is relatively simple so long as the top baffle is properly maintained.

In locations where there is an existing surface spill into open water, fish also move seaward easily providing the head is not excessive.

The Resource Branch is attempting to open small surface spillways at power station dams in order to give the fish an alternate route to turbine draft tubes. Spillways so developed need cushioning pools or a flume leading into the tailrace.

Stoplog Removal

On some small watersheds it may be feasible in some cases to provide a stoplog type of water control structure which could be opened during fish migration periods and left closed during low flow periods when fish movements are not taking place.

By-pass Channels

Under certain circumstances the Resource Branch will accept by-pass channels providing they are accompanied by a drawdown structure or spillway for flood flows.

APPENDIX A

REFERENCES

1. Avis, W.S., Drysdale, P.P., Gregg, R.J., Scorgill, M.H., Dictionary of Canadian English, The Senior Dictionary, Gage Education Publishing Limited, Toronto 1973.

2. Watercourse Alteration Regulation under the New Brunswick Clean Environment Act.

3. Letter Symbols and Glossary for Hydraulics with Special Reference to Irrigation, American Society for Civil Engineers

4. Handbook of Steel Drainage and Highway Construction Products, Second Edition. Prepared under the direction of the Highway Task Force for Committee of Galvanized Sheet Producers, Committee of Hot Rolled and Cold Rolled Sheet and Strip Producers, Americal Iron and Steel Institute; New York, 1971.

5. Guide to Bridge Hydraulics, ed. C.R. Neill, Roads and Transportation Association of Canada, Published by University of Toronto Press; Toronto 1973.

6. Bank and Shore Protection in Calfornia Highway Practice, Business and Transportation Agency, Department of Public Works, Division of Highways, State of California, 1970.

7. Hough, Stansbury and Associates, Limited, Design Guidelines for Forest Management, Ontario Ministry of Natural Resources.

8. Task Force on Nomenclature for Hydraulics Committee on Hydraulic Structures Nomenclature for Hydraulics, Hydraulics Division, American Society of Civil Engineers.

9. Mohr, Adolph W. "Development and Future of Dredging". Journal of the Waterways, Harbours and Coastal Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 100, No. WW2, May 1974.

10. Cable, Carl C. "Optimum Dredging and Disposal Practices In Estuaries". Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol. 95, No. HY1, January 1969.

11. Gray, D.H., Leiser, A.T., Biotechnical Slope Protection and Erosion Control, Published by Van Nostrand Reinhold Ltd. 1410 Birchmount Road, Scarborough, Ontario.

APPENDIX B

DEFINITIONS

DEFINITIONS

Please note that these definitions are for administrative purposes only and do not in themselves represent legal interpretation of the listed terms.

- A -

aboideau - In Nova Scotia and New Brunswick, a sluice gate in the dyke along the Bay of Fundy; a dyke itself, ; by extension applicable to any structure of this type in the Province, built to exclude tidal water,

abutment - a wall supporting the end of a bridge or span, and sustaining the pressure of the abutting earth,

anadromous - a behaviour characteristic of certain species of fish, ex. Atlantic Salmon, in which they migrate from salt water to fresh water to spawn.

aggradation - progressive raising of a channel bed by accumulation of sediment,

alteration - see "Watercourse Alteration"

anchor-ice - ice that forms on the bed of a stream,

apron - protective material laid on the stream bed to prevent scour,

apron, launching - an apron designed to settle and protect the side slopes of a scour hole after settlement,

aqueduct - a conduit, usually of considerable size, used to convey water. The conduit may consist of one or more of the following: canal, pipeline, tunnel, siphon or so-called "inverted siphon", arch - a specific type of culvert formed to an arch shape resting on abutments,

area - the amount of surface included between certain closed boundary lines; any particular extent of surface region, or tract,

area, catchment - see drainage area

area, drainage - see drainage area

area, non-contributory - in hydrology, that portion of a drainage area that, because of physical characteristics or topography, does not contribute surface runoff into a river system,

armor - the artificial surfacing of bed, banks, shore or embankment to resist erosion or scour. Revetment is bank protection by armor, that is by facing the bank or embankment with erosion resistant material

armor devices include the following:

- rigid - sacked concrete, asphaltic slope paving, pneumatically applied asphaltic mixtures,
- flexible - gabions, willow mattress, salvaged pavement slabs,
- self-adjusting flexible - rock slope protection, uncoursed broken concrete, precast concrete sections,

- B -

backwater - raised water levels produced by obstructing or constricting a channel,

baffle - a pier, vane, sill, fence or mound built on the bed of a stream to parry, deflect, check or disturb the flow, or to float on the surface to deflect or dampen cross currents or waves,

banks - the ground bordering a river, lake, etc.,

bank, left (right) - the bank on the left (right) side of the channel looking downstream,

bank protection	-	in a narrow sense, revetment or other armor stabilizing a bank against erosion; more generally, any means to accomplish the purpose, including devices deflecting the erosion forces away from the bank,
bar	-	(1) a site in a channel of a watercourse where sand and gravel deposits have accumulated; (2) the deposits themselves,
barrage	-	a diversion dam,
basin area	-	area within the watershed; drainage basin; also, the area of such a basin,
beach	-	the almost flat shore of sand or small stones over which water washes when high or at high tide,
bed	-	the ground under a body of water,
bed load	-	material dragged along in contact with the bed of a watercourse,
berm	-	same as a dyke but smaller,
bog	-	area of soft, wet spongy ground consisting chiefly of decayed or decaying moss or other vegetable matter,
bogan	-	in the Maritimes, a backwater or quiet tributary of a river,
boom	-	floating log or similar element designed to dampen surface waves or control the movement of drift,
box culvert	-	a culvert of rectangular or square cross-section,
break water	-	a wall or barrier built to break the force of waves,
bridge	-	a structure built over a river (watercourse) etc. so that people, trains, etc. can get across,
brook	-	a small watercourse,
brush	-	a thick growth of shrubs, bushes, small trees, etc.,

bulkhead	a steep or vertical structure supporting natural or artificial embankment,
by-pass pond	a pond connected to a watercourse by inlet and outlet pipes so as to obtain water from that watercourse,

- C -

canal	an artificially constructed open channel (excavated in natural ground) for the conveyance of water and/ or navigational uses; generally larger than a ditch or lateral,
catchment basin	same as basin area
causeway	a raised road or path, usually built across wet ground, shallow water, etc.,
CFS	cubic feet per second, also cusecs
channelization	changes to an existing channel's width and/or depth, or straightening of meanders by cutoffs, or construction of a completely new channel,
channel	(1) the open depression in which water may or does flow; (2) the space above the bed and between the banks of a stream (watercourse),
channel cleaning	removal of debris and/or fluvial deposits to maintain hydraulic conditions for unobstructed flow,
channel maintenance	see channel cleaning, and debris removal
chute	a high velocity conduit for conveying water to a lower level; an inclined drop or fall,
Clean Environment Act	An Act of the Legislature of New Brunswick, Chapter C-6 of the Revised Statutes of the Province of New Brunswick 1973, relating to environmental protection. The Watercourse Alteration Regulation is a regulation under that Act,

closed arch - a specific type of culvert similar to an arch and resting on abutments but over an artificial watercourse bed,

CMS - cubic meters per second, also cumecs

cofferdam - a watertight enclosure built in a shallow river or lake and pumped dry so that the foundations of a bridge, etc. may be built,

confluence - the place where two or more watercourses come together,

constriction - narrowing of a channel to less than its normal or average width, as a result of man-made or natural side controls,

construction - the act of building or putting together,

crib work - an open-frame structure loaded with earth or stone ballast,

culvert - a conduit for conveying water through an embankment,

Distinction is made between culverts and storm sewers, mostly on the basis of length and the types of inlets and outlets. Distinction is also made between culverts and bridges in that the top of a culvert does not serve as a road surface, whereas a bridge is a definite link in a roadway surface,

cut-off - natural or artificial channel short-cutting a meander loop or winding length of channel,

- D -

dam - a barrier to confine or raise water for storage or diversion or to create a hydraulic head,

types of dams:

arched dam - a curved dam, convex upstream, that depends on arch action for its stability. The load is transferred by the arch to the canyon walls, or other abutments, types of dams continued:

diversion dam - a barrier built for the purpose of diverting part or all the water from a stream (watercourse) into a different course,

earth dam - a barrier composed of earth, clay, sand or sand and gravel, or a combination of sand and rock,

framed dam - a barrier generally built of timber framed to form a water face, supported by struts,

gravity dam - a solid masonry dam, with a transverse cross-section approximately triangular in shape which depends upon its own weight for stability against overturning or horizontal movement, the mass being such that the horizontal thrust on the upstream face is transmitted to a point within its foundation usually within the middle third,

hollow dam - a barrier usually of reinforced concrete consisting essentially of slabs supported by transverse buttresses. The load is taken by the slabs and transferred to the foundations through the buttresses,

hydraulic-fill dam - a dam composed of earth, sand, gravel, etc. sluiced into place; generally the fines are washed towards the center of greater imperviousness,

movable dam - a barrier that may be opened in whole or in part. The movable part may consist of gates, stop-logs, needles, wickets, or any other device whereby the areas for flow through or over the dam may be controlled,

multiple-arch dam - a barrier consisting of a series of arches supported by buttresses or piers. The load is transferred by several arches to the foundation through the buttresses,

rock-rilled dam - a dam composed of loose rock usually dumped in place; often with the upstream part constructed of hand-placed, or derrick-placed, rock and faced with rolled earth or with an impervious surface of concrete, timber or steel,

debris dam - a barrier built across a stream channel to store debris, such as sand, gravel, silt, driftwood, etc., debris - floating or sunken trash, dead, or decaying vegetation,

debris removal - removal of debris from the banks or bed of watercourse bed,

degradation - progressive lowering of a channel bed by erosion,

discharge - the quantity of water, silt or other mobile substances passing along a conduit per unit of time; rate of flow; cubic feet per second, litres per second, millions of gallons per day, etc.,

discharge, bankfill - discharge that, on the average, fills a channel to the point of overflowing,

ditch - an artificial channel, usually distinguished from a canal by its smaller size,

diversion - a new channel dug to change the position of the watercourse bed,

downstream - objective; in the same direction as the normal flow of the watercourse,

drainage - (1) the process of removing surplus ground or surface water by artificial means,

(2) the manner in which the waters of an area are removed,

(3) the area from which waters are drained; a drainage basin,

drainage area - (1) the area (square metres, acres, etc.) of a drainage basin,

(2) catchment area, drainage basin,

(3) the area that is drained by a watercourse,

drainage pattern - the system of watercourses which provides drainage of an area,

dredging - the act of removing material from the bed of watercourse by mechanical means,

dug-out - an excavation constructed to impound water,

dyke	-	(1) an impervious bank of earth built as a defence against flooding by a river or the sea, (2) an impervious bank of earth constructed to obstruct or confine water from entering or leaving an area of land,
dyked land	-	in New Brunswick, agricultural land protected by dykes,

- E -

ecology	-	the (branch of biology) science dealing with the relation between living organisms and their environment; the relationship between and distribution of human groups relative to resources with consequential social and cultural patterns,
environment	-	all of the surrounding condition and influences that affect the development of a living thing,
erosion	-	wearing away of land by physical and chemical action in moving water or air,
erosion control work	-	construction to lessen erosion of the banks of a watercourse,
estuary	-	tidal reach at the mouth of a river,
farm pond	-	an impoundment of water primarily for agricultural use,
filter	-	a device or structure for removing solid or colloidal material, usually of a type that cannot be removed by sedimentation from water, sewage or other liquid. The liquid is passed through a filtering medium, which may consist of a granular material such as sand, infusorial, or diatomaceous earth, anthracite coak, etc.,
fisheries	-	commercial or recreational fish harvesting in rivers, lakes and other watercourses; the fish stocks,
fishery enhancement	-	the creation of conditions more amenable to the rearing or taking of fish for commercial or recreational purposes,

fish ponds	-	impoundments of water primarily to hold fish for rearing, or for recreational fishing,
fishway, fish ladder, fish lift	-	a structure to facilitate the migration of fish around dams or other obstructions in watercourses,
fish screen	-	(1) a device intended to prevent the entrance of fish into a conduit, (2) can be a device to prevent fish migration to another channel,
flood	-	(1) a relatively high flow as measured by either gauge height or discharge quantity. Also any flow equal to or greater than a designated basic flow, (2) to inundate or overflow,
flood, annual	-	(1) the highest discharge in a water year, (2) the flood which was equalled or exceeded once each year on the average,
flood, computed maximum	-	the largest momentary flood discharge believed possible from a consideration of meteorologic conditions and snow cover within the watershed,
flood plain	-	flat land bordering a watercourse and subject to flooding,
flood protection	-	measures taken to protect lives, or property from risk of flood,
flood walls	-	a structure intended to protect a flood plain from inundation, built along the bank of a watercourse, differing from the more general term of levee in that it consists in whole or in part of a reinforced concrete wall or similar structure,
floodway	-	(1) the channel of a watercourse and adjacent lands which are reasonably required to carry and discharge the regulatory flood of a twenty year return period on the area, (2) the diversion channel to carry any flood water thus protecting a certain area,
fluvial	-	of or produced by the water flow of a watercourse,

flume	- an open conduit of timber, concrete, metal, etc. on a prepared grade, trestle or bridge. A flume holds water as a complete structure. A concrete-lined canal would still be a canal without the lining, but the lining supported independently would be a flume. A large flume is also termed an aqueduct,
ford	- a place where a river or stream is shallow enough to be crossed by walking or driving through the water, further to above definition, the ford must be over an area with a firm bottom,

- G -

grade	- profile of the center of a roadway, or the invert of a culvert or sewer. Also refers to slope, or the rise or fall or the grade line to its length,
gradation	- sieve analysis of aggregates,
gravel	- pebbles and rock fragments coarser than sand, Detritus larger than sand and smaller than cobble, arbitrarily ranging in diameter from 0.2 to 2 in.,
gravel removal	- the removal of material from banks or beds of watercourses,
groin	- a bank or shore protection structure in the form of a barrier placed oblique to the primary motion of water designed to control movement of bed load,
grouted	- bonded together with an inlay or overlay of cement mortar,

- H -

head	- the height of water above any point or place of reference, used also in various compound words, such as energy head, entrance head, friction head, static head, pressure head, lost head, etc.

head pond - an impoundment of water of any size, behind a man-made dam, which has as its primary function the providing of head for a prime mover,

high water - a water level which is higher than normal in lakes, rivers and streams,

design high water - stage adopted for design, usually based on empirical frequency of recurrence,

hydraulic - pertaining to water in motion and the mechanics of that motion,

hydraulic elements - the depth, area, perimeter, mean depth, hydraulic radius, velocity, energy, and other quantities pertaining to a particular stage of flowing water,

hydrologic - pertaining to the cyclic phenomena of waters of the earth -- successively as precipitation, and quantitatively as a distribution and concentration,

hydrostatic - pertaining to the pressure by and within water due to gravitation acting through depth,

hydrotechnical - pertaining to water related sciences and technology,

- I -

impervious - a term applied to a material through which water cannot pass or through which water passes with great difficulty; impermeable,

instrument pools or wells - natural or artificial sites on watercourses where measurement devices may be used for hydrotechnical purposes in sheltered or preferred conditions,

irrigation - the artificial application of water to lands for agricultural purposes,

irrigation ditches - a ditch which delivers water for irrigation,

- J -

jam	-	accumulation of debris, ice or other material so as to become wedged in the channel of a watercourse, and forming a partial or complete obstruction,
jetty	-	an elongated artificial obstruction projecting into a watercourse or the sea from bank or shore to control shoaling and scour by deflection of the strength of currents and waves,

- L -

lacustrine	-	of or pertaining to a lake or the environment of a lake,
land extension	-	the extension of land by dumping or filling into a lake, bay, or inlet,
landing stages (or yards)	-	material collection sites, generally involving wood products, but also includes mining waste material, other usable or waste products,
lagoon	-	a dyked or bermed impoundment for aqueous material, the dyke or berm completely surrounds the lagoon,
lake	-	an inland body of water, larger than 4 hectares, not man-made,
levee	-	an embankment on or along the bank of a stream or lake to protect outer lowlands from inundation, a dyke or embankment for the protection of lands from inundation, or for the purpose of confining stream flow,
lining	-	a protective covering over all, or a portion of, the perimeter of a reservoir or conduit to resist erosion or corrosion, to prevent seepage losses, to withstand pressure, or to remove flow conditions,
littoral	-	pertaining to or along the shore,

locks - the part of a canal, dock, etc. in which the level of the water can be changed by letting water in or out in order to raise or lower ships,

log chute, log-way - a by-pass around or through a dam for logs and drift,

log driving - a means of transport, the floating of logs down a river usually at high flows to be caught in booms farther down stream and processed,

log driving works - dams, chutes, channel maintenance and modifications constructed or done to aid the transport of logs down a watercourse,

- M -

mattress - bank protection structure consisting of a broad flat cage or network filled with stone and other local materials,

marsh - low land covered at times by water; soft, wet land; swamp,

marsh lands - see dyked land

meanders - channel pattern consisting of characteristic alternating bends formed by stream processes,

mud - a soft, saturated mixture mainly of silt and clay,

- N -

natural - produced by nature; based on some things in nature; not artificial,

navigation - the movement of people and goods by water,

navigation lock - see locks

Navigable Waters Protection Act - The Navigable Waters Protection Act, R.S.C., 1970, Chapter N-19, is a Federal Statute designed to protect the public right of navigation in navigable water by prohibiting the building or placement of any work in, upon, over, under, through, or across a navigable water without approval of the Minister of Transport. An approval granted by the Minister in respect of a work and the site and plans thereof pursuant to the Statute is only an authorization to interfere with the public right of navigation to the extent of the work for which site and plans have been approved; ref M.O.T. publication

navigable water - there is no definition of navigable water given in the Navigable Waters Protection Act. If requested the Ministry of Transport will give its views as to whether a particular body of water is navigable. The Ministry of Transport takes no responsibility for having advised that in its opinion a water is not navigable if a court later holds that it is, or vice versa,

- O -

obstruction - those watercourse alterations which involve the construction of structures on the watercourse which impede the flow of water and/or prevent fish migration,

- P -

peak - maximum momentary stage or discharge of a stream in flood,

pier - (1) a vertical support of an engineering structure, for example, an intermediate support for the adjacent ends of two bridge spans,

(2) a structure built out or into the water along which a boat or vessel may lie. Used locally to mean wharves and docks,

piling - structural members driven in beds of streams and other bodies of water and/or grouped in bents or sheets,

pipe	-	a tube through which a liquid or gas flows,
pipe arch	-	a specific type of culvert with a multi-radius shape of greater span than rise, an arch-shaped top and a curved integral bottom,
pipe crossing	-	the structures, appurtenances and pipe which together consitiute a crossing of a watercourse by the said pipe, usually part of a pipeline,
pools	-	depressions in a bed of watercourse frequently a resting place for fish,
ponds	-	a natural or artificial body of water smaller than a lake (i.e. less than four hectares in surface area),
Professional Engineer	-	a person who is a member or licensee of the Association of Professional Engineers of the Province of New Brunswick, as described in the New Brunswick Engineering Profession Act,

- Q -

quays	-	see wharf, landing stage,

- R -

rapids	-	swift and turbulent flow, without pronounced falls,
recurrence (return period) interval	-	average period of years between observed or predicted occurrences of a discharge or stage equalling or exceeding a stated value,
regime	-	general pattern of variation around a mean condition, as in flow regime, tidal regime, channel regime, sediment regime, etc., a set of physical characteristics of the river,
removal	-	the tearing down and taking away,

rerouting rivers, rerouting watercourses - the shifting of a watercourse to a new channel, with the new channel extending outside the original drainage basin, generally transferring the water to a different watercourse,

reservoir - an artificial impoundment of water for the purpose of storage for latter use. Reservoirs are distinguished by monthly and/or annual regulation of flows while head ponds cater to daily and weekly fluctuations only,

retard - a bank protection structure designed to check riparian velocity and induce silting or accretion,

revetment - see armour

riparian - (adjective) of or on the bank of a river, a lake,

rip-rap - cobbles, boulders, broken stone or other hard materials dumped or placed along as bank or stone protection,

river adjustments - a form of channelization, the alteration of a watercourse's cross-sectional shapes,

riverine - of or having to do with a river,

- S -

salmonoid - of or related to the salmon family,

sand - granular soil or detritus coarser than silt and finer than gravel, ranging in diameter from 0.002 to 0.2 in.,

scour - lowering of the stream bed or the undermining of the foundations by erosive action of flowing water,

seepage - small flow of water through cracks, voids and crevices,

settling ponds - artificial ponds, sometimes lagoons, primarily for the purpose of separating suspended particles from water by gravity settling, spring - a surface where, without the agency of man, water issues from a rock or soil onto the land or onto the body of water, the place of issuance being relative restricted in size,

stilling pond (water cushion) - (1) syn. with instrument pool or well;

(2) a type of energy dissipator,

stream - (1) in a general sense, a flowing watercourse,

(2) a flowing watercourse intermediate in size between a brook and river,

stream alteration - (1) any physical change to the banks or bed of a stream or to the flow therein;

(2) historically, used in New Brunswick in connection with the now repealed Water Act,

swamp - a tract of low lying wood land which is intermittently saturated; dampness due to some obstruction in normal drainage; often formed when a lake basin fills up and vegetation occurs. It differs from a marsh in that it is not a bog in that it consists largely of decaying vegetation although peat is rare,

- T -

tanks - any fully enclosed storage vessel for any type of fluid,

tree removal - harvesting or cutting and taking away of trees near a watercourse,

trestle - a frame used as a support,

- U -

upstream - (1) against the current of the stream, up a stream,

(2) a directional adjective, the opposite of downstream,

- V -

vegetation - plant life, growing plants; the growth of plants,

- W -

Water Act - a repealed Act of the Legislature of New Brunswick, Section 14 of which, was with respect to stream alterations

water control structures - for our purposes, includes spillways, aboideaux, sluiceways and other structures which control the flow by mechanical means,

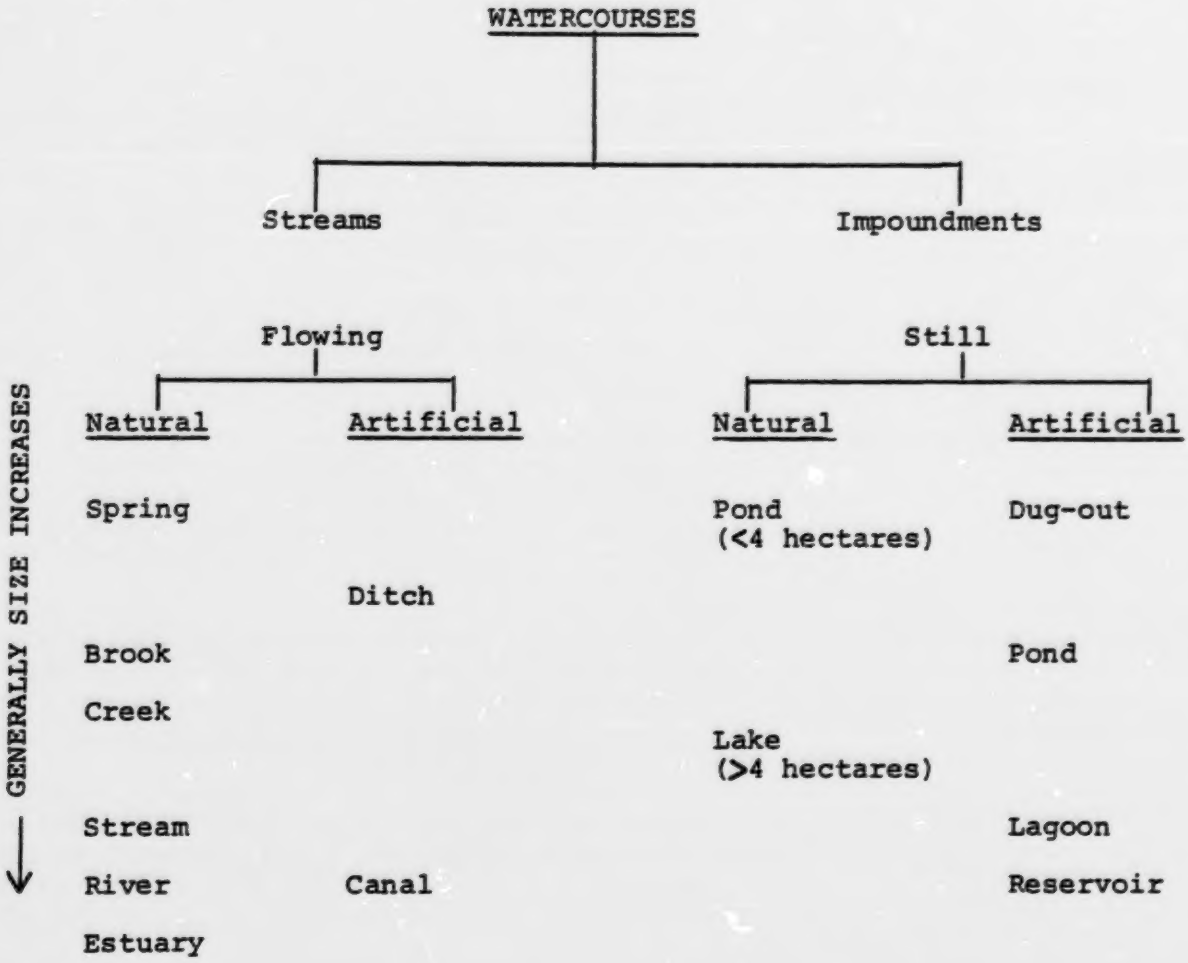
watercourse (legal) - the full width and length, including the beds, banks, sides and shoreline of any river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, or any part thereof, the primary function of which is conveyance or containment of water whether the flow be continuous or not,

watercourse alteration (legal) - any change made intentionally, at, near or to a watercourse or to water flow in a watercourse, both temporary and permanent, and includes -

(i) any changes made to existing structures in the watercourse including repairs, modifications or removal, whether the waterflow in the watercourse is altered or not;
(ii) the temporary or continuous operation of machinery on the bed of a watercourse other than at a recognized fording place;
(iii) any removal of sand, gravel, rock, topsoil or similar material from a watercourse or within thirty metres of the bank of a watercourse;
(iv) any removal of vegetation from the bed or bank of a watercourse; and
(v) any removal of trees within ten metres of the bank of a watercourse,

Watercourse Alteration Regulation	-	a regulation under the New Brunswick Clean Environment Act respecting watercourse alterations,
Watercourse Alteration permit	-	a permit signed by the Minister of Municipal Affairs and Environment and issued accordingly to the Watercourse Alteration Regulation.
water intake structure	-	any structure needed to enable the withdrawal of water from a watercourse,
waterway	-	(1) a navigable inland body of water or (2) the section under a bridge available for passage of water,
weir (measuring)	-	a device for measuring the flow of water. It generally consists of rectangular, trapezoidal, triangular, or other shaped notch in a thin plate with a vertical plane through which water flows. The weir head is an index of the rate of flow,
wharves	-	(1) a structure built along or at the bank of a watercourse for ships to lie alongside as during loading and unloading; a dock, (2) a similar structure used for recreational purposes, including angling,
wire baskets	-	a basket or cage filled with earth or stone and placed as, or as part of, a bank protection structure, earth is meant to be coarse gravel or rock,

FIGURE A-1


WATERCOURSES
Streams
Impoundments
Flowing
Still
Natural
Artificial
Natural
Artificial
GENERALLY SIZE INCREASES
Spring
Ditch
Brook
Creek
Stream
River
Estuary
Canal
Pond
(<4 hectares)
Lake
(>4 hectares)
Dug-out
Pond
Lagoon
Reservoir

APPENDIX C

"BEFORE YOU ALTER A WATERCOURSE"

THINGS YOU SHOULD KNOW

"BEFORE YOU ALTER A WATERCOURSE"

Things you should know

In advance of planning or undertaking a change or alteration to a Watercourse in New Brunswick there are some facts of which you should be aware. Protecting the streams, rivers and lakes of the Province from detrimental watercourse alterations is the purpose of the Watercourse Alteration Regulation.

The Clean Environment Act defines a "watercourse" and a "watercourse alteration" as follows:

> "watercourse" means the full width and length, including the beds, banks, sides and shoreline of any river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, or any part thereof, the primary function of which is the conveyance or containment of water whether the flow be continuous or not;
>
> "watercourse alteration" means any change made intentionally, at, near or to a watercourse or to water flow in a watercourse, both temporary and permanent, and includes;
>
>> any changes made to existing structures in the watercourse including repairs, modifications or removal, whether the waterflow in the watercourse is altered or not,
>>
>> the temporary or continuous operation of machinery on the bed of a watercourse other than at a recognized fording place,
>>
>> any removal of sand, gravel, rock, topsoil or similar material from a watercourse or within thirty metres of the bank of a watercourse,
>>
>> any removal of vegetation from the bed or bank of a watercourse, and
>>
>> any removal of trees within ten metres of the bank of a watercourse.

It is illegal to make or carry out any watercourse alteration or cause any watercourse alteration to be commenced, made or carried out unless authorized to do so by a permit issued by the Minister, except for a few limited types of watercourse alteration exempted under Subsection 3(4) of the regulation.

HOW TO MAKE APPLICATION FOR A PERMIT

Application forms for Watercourse Alterations and aid in completing them, can be obtained from:

Water Resource Planning Branch
Environmental Management, Land & Water Use Division
Department of Municipal Affairs and Environment
P.O.Box 6000
364 Argyle Street, 3rd Floor
Fredericton, New Brunswick
E3B 5H1 Tel: (506) 453-2353

or from one of the district offices of the following agencies;

New Brunswick Department of Municipal Affairs and Environment
New Brunswick Department of Natural Resources and Energy
New Brunswick Department of Agriculture
(Engineering Branch)
The Department of Fisheries and Oceans

The completed application form, together with three copies of all required documents and the appropriate fee, should be submitted to the Water Resource Planning Branch (Address Above) at least three months in advance of the anticipated starting date to ensure sufficient time for review of your application.

Because of the multi-agency involvement, the time required for processing most applications will be six (6) to eight (8) weeks.

WHAT TO DO IF YOU DO NOT RECEIVE A PERMIT

If your proposed works are considered detrimental to the public interest, the water resource, or the aquatic habitat you will receive a letter from the Water Resources Branch of the Department of the Environment explaining that your proposal has not been approved because of a specified reason or reasons.

If you are dissatisfied with any explanation you receive from the Department you may appeal to the Minister to request review of your application in accordance with the Appeal Regulations -- Clean Environment Act (Regulation 84-179).

WHAT HAPPENS IF YOU DON'T COMPLY WITH THE CLEAN ENVIRONMENT ACT?

Where a watercourse alteration or the work associated therewith is not commenced, made or carried out in compliance with the Clean Environment Act, the Watercourse Alteration Regulation, the terms and conditions upon which a permit was issued or any order, direction or demand of the Minister, the person to whom the permit was issued, or if no permit was issued, the person commencing, making or carrying out the watercourse alteration shall be liable for prosecution under the Clean Environment Act. In the case of conviction under the Act, fines of up to $50,000 per day for each day the offence continued may be levied by the court.

WHAT ARE THE OTHER AGENCIES DEALING WITH WATERCOURSE ALTERATION?

There are legislations other than the Clean Environment Act which also bear on Watercourse Alterations --

Legislation	Administrating Agency
1. Navigable Waters Protection Act	Canada Ministry of Transport
2. Canada Fisheries Act	Fisheries and Oceans
3. N.B. Fish and Wildlife Act	N.B. Natural Resources & Energy
4. Quariable Substance Act	N.B. Natural Resources & Energy
5. Crown Lands Act	N.B. Natural Resources & Energy

The Department of Fisheries and Oceans and the Department of Natural Resources and Energy are participants in the New Brunswick Watercourse Alteration Protection Program. These agencies help prepare guidelines for review, or may review, applications for Watercourse Alteration Permits (no separate applications required). However, they remain responsible for their own legislation and attainment of their goals and objectives.

If you live within an incorporated municipality or within the boundaries of a Planning District, you should be positive that your proposed alteration does not violate any municipal or planning by-laws. It is the applicant's responsibility to obtain the necessary approvals.

The Federal Ministry of Transport must be informed of any proposed alteration to a Navigable Waterway and they may require a separate application to be made to them under the Navigable Waters Protection Act.

The New Brunswick Department of Agriculture also reviews Watercourse Alteration applications for farmers as well as for most agricultural projects requiring financial, engineering, or legal assistance.

APPENDIX D

PROCEDURAL INFORMATION REGARDING PROCESSING OF APPLICATIONS FOR WATERCOURSE ALTERATION PERMITS

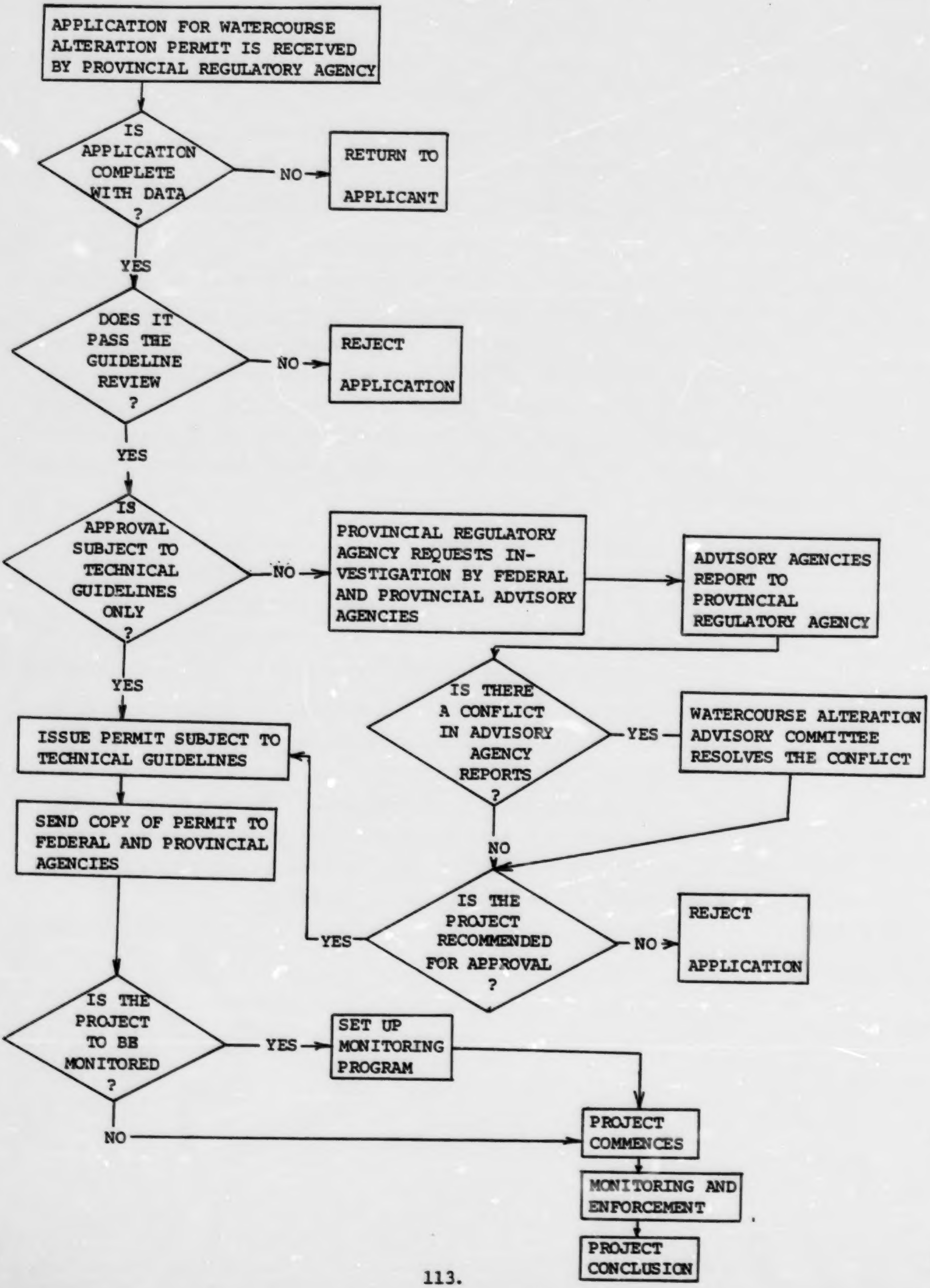
PROCEDURAL INFORMATION REGARDING PROCESSING OF APPLICATIONS FOR WATERCOURSE ALTERATION PERMITS

The purpose of this appendix is solely to inform the personnel working for the regulatory or advisory agencies on the processing of applications for Watercourse Alteration Permits on the duties and responsibilities of the various government agencies. It is not attempted here to define the specific responsibility of any employee in an agency, as this is left to the discretion of the agency involved.

The following flow chart shows the flow of an application through the system. In New Brunswick, the regulatory agency is the New Brunswick Department of Municipal Affairs and Environment. The overall control of the Watercourse Alteration Program rests with that Department.

Table 1.1 of these Guidelines entitled "Application Review Requirements" states whether an application for a given type of watercourse alteration is likely to be reviewed solely by the regulatory agency using the technical guidelines and their own technical checks, or by the regulatory agency in conjunction with the advisory agencies of which it has requested review of an application.

SYSTEM FLOW CHART


APPLICATION FOR WATERCOURSE ALTERATION PERMIT IS RECEIVED BY PROVINCIAL REGULATORY AGENCY
IS APPLICATION COMPLETE WITH DATA ?
NO
RETURN TO APPLICANT
YES
DOES IT PASS THE GUIDELINE REVIEW ?
NO
REJECT APPLICATION
YES
IS APPROVAL SUBJECT TO TECHNICAL GUIDELINES ONLY ?
NO
PROVINCIAL REGULATORY AGENCY REQUESTS INVESTIGATION BY FEDERAL AND PROVINCIAL ADVISORY AGENCIES
ADVISORY AGENCIES REPORT TO PROVINCIAL REGULATORY AGENCY
IS THERE A CONFLICT IN ADVISORY AGENCY REPORTS ?
YES
WATERCOURSE ALTERATION ADVISORY COMMITTEE RESOLVES THE CONFLICT
NO
YES
ISSUE PERMIT SUBJECT TO TECHNICAL GUIDELINES
SEND COPY OF PERMIT TO FEDERAL AND PROVINCIAL AGENCIES
IS THE PROJECT RECOMMENDED FOR APPROVAL ?
YES
NO
REJECT APPLICATION
IS THE PROJECT TO BE MONITORED ?
YES
SET UP MONITORING PROGRAM
NO
PROJECT COMMENCES
MONITORING AND ENFORCEMENT
PROJECT CONCLUSION

THE WATERCOURSE ALTERATION PROGRAM

DEPARTMENT OF MUNICIPAL AFFAIRS AND ENVIRONMENT OBJECTIVES

What does the New Brunswick Department of Municipal Affairs and Environment hope to accomplish with the operation of a Watercourse Alteration Program?

ANSWER: The New Brunswick Department of Municipal Affairs and Environment wants to operate and coordinate an EFFECTIVE program for the CONTROL of alterations to watercourses. The Department of Municipal Affairs and Environment is defined as the REGULATORY AGENCY.

This program must include and recognize the potential of alterations as follows:

(a) effects on the public

- changes in river regime; including erosion, stream meandering, increased potential for flooding, bed material transport;
- changes in the availability of water of a suitable quality for domestic, and industrial consumption, as well as for a number of other uses including agriculture, forestry, commercial fishing, mineral development, tourism, outdoor recreation, power production, and industrial cooling processes;
- changes to navigation and infringement of navigation rights;
- changes in the waterway which reduce its historical value or the potential of a site for archaeological use and investigation.

(b) effects on aquatic habitat and wildlife habitat,

- changes which affect fish habitat and conservation;
- changes which affect angling, hunting and trapping;
- changes which affect waterfowl nesting areas;
- changes which affect other fauna;
- changes which accelerate or retard the growth of aquatic flora

The principle operational role of the Water Resource Planning Branch in this program is to protect the interests of the public apart from the navigation and historical concerns.

The Water Resource Planning Branch as coordinator of the New Brunswick Watercourse Alteration Program wishes to administer a suitable and equitable program, which represents the interests of the various agencies and effectively fulfills the goals of these agencies, without causing undue inconvenience to any person wishing to commence a stream alteration.

N. B. TOURISM, RECREATION AND HERITAGE

One of the main tasks of the Department of Tourism, Recreation and Heritage's archaeological program is the salvaging of archaeological sites threatened by destruction. In this regard any means by which we can learn of land disturbance is of great potential value. What the Dept. of Tourism, Recreation and Heritage hopes to gain from the Watercourse Protection Program is information in advance of alterations to stream course. Archaeological survey has shown that a good portion of the sites of interest lie along watercourses, particularly major ones. The permits pinpoint the disturbance so that the area can be evaluated for archaeological potential.

The Dept. of Tourism, Recreation and Heritage is not as interested in controlling watercourse alterations as it is of learning of the alterations. If an archaeological site was found to be endangered the control of this would probably fall on our own legislation and actions. The major assistance from the permit system could be delay of the granting of the permit so that the appropriate research can be undertaken.

N. B. DEPARTMENT OF NATURAL RESOURCES AND ENERGY

The New Brunswick Department of Natural Resources and Energy has responsibility for the administration and enforcement of the Fish and Wildlife Act. It is concerned with damage or loss of fish and wildlife habitat or to water quality for human use. The Department of Natural Resources and Energy actively cooperate with the New Brunswick Department of Municipal Affairs and Environment in the Watercourse Alteration Program to fulfill its legislative responsibilities and to assist in minimizing or eliminating damage to the aquatic environment.

Refer to Chapter 4 of the Technical Guidelines for Legislation.

CANADA DEPARTMENT OF FISHERIES AND OCEANS

The Dept. of Fisheries and Oceans administers provisions of the Canada Fisheries Act (Refer Chapter 4 of the Technical Guidelines for an account of Legislation). They are prepared to provide engineering advice and assistance in the design and construction of fishways. Functional designs can be prepared for the owners when fish passage facilities are required. Under special arrangement, full services of design (including structural) and construction supervision may be possible.

N. B. DEPARTMENT OF AGRICULTURE

Agricultural Engineering Branch

The responsibilities of the Agricultural Engineering Branch, New Brunswick Department of Agriculture, with regards to these regulations is to supply engineering and technical services to the agricultural sector of the province.

Offices of the Engineering Branch are located as follows, where copies of regulations, application forms, and advice can be obtained.

Fredericton

Agricultural Engineering
N.B. Dept. of Agriculture

Research Station
P.O. Box 6000
E3B 5H1 453-2272

Moncton

Agricultural Engineering
N.B. Dept. of Agriculture

Assumption Place, 8th Floor
P.O. Box 5001
E1C 8R3 858-2552

Sussex

Agricultural Building
N.B. Dept. of Agriculture

P.O. Box 5001
E0E 1P0 433-3073

Woodstock

Agricultural Engineering
N.B. Dept. of Agriculture

P.O. Box 1600
E0J 2B0 328-8851

Bathurst

Agricultural Engineering
N.B. Dept. of Agriculture

P.O. Box 540
E2A 3Z4 546-9971

Perth

Agricultural Engineering
N.B. Dept. of Agriculture

P.O. Box 68
E0J 1V0 273-2269

Grand Falls

or N. B. Department of Agriculture offices in Edmundston, Chatham, Richibucto, Tracadie, Dalhousie, and St. Quentin.

APPENDIX E

INFORMATION REQUIREMENTS

INFORMATION REQUIREMENTS

In order to give an application for a Watercourse Alteration Permit fair and adequate review, enough information must be submitted with the application to allow the regulatory and advisory agencies to identify and assess environmental effects of a proposed watercourse alteration.

This appendix summarizes the information requirements for each type of watercourse alteration. Firstly, the information required on the application form itself is listed. This is basically the same for all watercourse alteration group.

INFORMATION REQUIRED ON THE APPLICATION FORM COMMON TO ALL WATERCOURSE ALTERATION PROJECTS:-

The following information should be clearly printed in full in the appropriate spaces on the application form itself, WRB-ALT-1.

(1) Name of Applicant

If that person is applying for a firm, then that person's name should be given along with the Company's name in the following format: "John Doe for Dawson Industries".

The person completing the application should sign irregardless of whether the application was completed for himself or for a business.

(2) Address of Applicant

Use the address to which you desire an answer to be sent. In the case of a firm or business, the address should be that of the office involved.

(3) The Alteration

Describe the alteration including the size, shape and material, general type of project and the purpose of the project.

Examples:
- 8 foot diameter circular steel culvert
- 12 foot high, concrete gravity dam
- 20 m. span by 10 m. height, single span bridge

Location of Watercourse Alteration

(a) Watercourse name
(b) The name of the watercourse to which it is tributary
(c) County and Parish/Municipality

ADDITIONAL INFORMATION REQUIRED WITH THE SUBMITTAL OF AN APPLICATION FOR A WATERCOURSE ALTERATION PERMIT BY ALTERATION TYPE

Dams, Barrages - Reservoirs:

(1) Engineering scale drawings fully dimensioned to describe the size, shape and alignment of the structure and bearing the seal of a person licenced to practice as a Professional Engineer pursuant to the New Brunswick *Engineering Profession Act* are required.

(2) Specifications on the materials and workmanship are required. A note on the operation of the dam noting the maximum drawdown and operating schedule of the reservoir is required.

(3) A note from the Professional Engineer, on the variables considered in design, such as hydrology, uplift, foundation conditions, ice, fish passage, etc. is desirable.

(4) A description of the use of the structure plus provisions for proper inspection and maintenance, if built, is required.

(5) A note is desired from the Professional Engineer on the consideration during design given to flooding, reservoir sedimentation, euthrophication and water quality.

(6) Specifications for the removal of trees and brush from the reservoir including a schedule of construction activity are required.

Bridges: (Other than Temporary)

(7) Scale drawings fully dimensioned to describe the size, shape and alignment of the bridge plus approach roads, spur dykes and guide banks constructed with the bridge are required. These scale drawings should show the following:
   (a) the depth of piers and abutments below the bed of the watercourse,
   (b) the height of the bridge above the bed of the watercourse,
   (c) the distance between piers and abutments,
   (d) the waterway opening,
   (e) the design high water and the expected height of ice jamming,
   (f) the erosion control measures to be adopted.
   (g) the alignment of the bridge and its piers to the watercourse.

(8) The drawings should include cross-sections at the site and immediately upstream and downstream from the site.

(9) A note is desirable either on the scale drawings or application form, or as a separate attachment, stating the consideration given to:
  (a) bridge height and waterway opening in relation to the passage of water at high discharge without scour or velocity problems,
  (b) possible blockage by ice and logs,
  (c) backwater effects, channel shifting, bank erosion and training works,
  (d) local scour around piers and abutments,
  (e) any use of materials harmful to the environment,
  (f) the blockage of the channel during construction.

Constrictions:

(10) Drawings to scale full dimensioned to describe the size, shape, alignment and location of the constrictions are required.

(11) The drawings should include both a plan and a cross-section.

The drawings should show:
  (a) the amount of bank-to-bank width reduction of the watercourse,
  (b) the material to be used as fill or embankment material,
  (c) the erosion control measures to be adopted.

(12) Either on the scale drawings, the application form or an attachemnt to the application form, it should be shown that careful consideration was given to the following:
  (a) backwater effects and flooding,

(b) the possibility of ice jamming
(c) channel meandering
(d) general scour of the watercourse bed
(e) efforts and means to reduce siltation during construction.

Causeways:

(13) Drawings to scale with all the dimensions necessary to describe the size, shape and alignment of the proposed watercourse alteration are required. These drawings should include a cross-section across the watercourse at the site of the causeway, a profile of the bed of the watercourse extending from five hundred feet upstream from the site of the proposed causeway to five hundred feet downstream, and a plan showing the alignment of the causeway.

(14) The drawings should show any culverts or structures through the causeway giving their location, size, material and type.

(15) In the case of large causeways, the drawings should bear the seal of person licenced to practice as a Professional Engineer subject to the provisions of the New Brunswick Engineering Profession Act. Also, the design engineer should submit a detailed description of the consideration given to the causeway's effects on the aquatic environment sediment transport, river hydraulics and water passage, and water quality.

Culverts, Pipe Arches:

(16) The following information is required on or by a dimensioned sketch on the application form:
(a) Type of Conduit:
    Shape: Arch, pipe arch, round culvert, ellipse, underpass, box
    Material:

(b) Size of Conduit: end dimensions and length

(c) Slope: feet/foot or metres/metre

In most cases, the maximum slope is taken as 0.005 ft/ft for reasons of fish passage. However, if site conditions do not allow a culvert to be placed on so flat a slope then the applicant may propose a higher slope and write a detailed summary with the application justifying the choice of a higher slope. The applicant should provide baffles or other fish passage aids in long culverts placed on a high slope.

(d) Alignment:

Alignment or the relationship of the culvert or pipe arch to the stream. Generally, an alignment is preferred which causes the least change in the natural course of the watercourse. The alignment should be shown in the sketch on the back of the application form. If the watercourse is diverted for more than one hundred feet in the immediate vicinity of the conduit installation, then the project is usually considered to include a stream diversion. In such a case, the requirements of diversion projects must also be met.

(e) Erosion Control:

In most cases, it is assumed that some bank protection is provided and this a normal condition of the issued permit.

Information should be provided on the application form to describe the erosion control to be used.

(f) Relationship to Streambed:

Unless otherwise stated, it shall be assumed that the culvert is placed six to twelve inches below the bed of the stream. If this is not proposed, then the applicant must justify the variation in a note attached to the application form.

(g) The fill above the conduit:
A description of the fill to be placed around the conduits is desirable. The height of the fill above the top of the conduit and the streambed is required to determine allowable headwater depth.

Breakwaters, wharves, quays, landing stages, land extensions:

(17) Drawings to scale are required including a plan, profile and cross-section. On the application form, the information required, in addition to that common for all types of watercourse alterations, shall include:
(a) a note on backwater effects of any constriction, and
(b) provisions to protect against ice damage.

Dredging:

(18) Engineering scale drawings full dimensioned to describe the extent of the dredging and bearing the seal of a Professional Engineer is required.

Also, required is a description containing details on the following:
(a) the type of dredge
(b) the dredge operation including swing rate, depth of cut, soil flow to dredge, swing direction, etc.
(c) disposal plans for the dredged material,
(d) the soil character including a grain-size curve, median size, insitu unit weight, solids unit weight, etc.
(e) the provisions to be taken to reduce environmental damage.

Channelization:

(19) Engineering scale drawings fully dimensioned to describe the size, shape and alignment of both the old and new channel are required. These drawings which

should include x-sections, plans, and profiles for each channel should bear the seal of a person licenced to practice as a Professional Engineer pursuant to the New Brunswick Engineering Profession Act.

Also required is a description of the bed and bank material of the old channel and the material the new channel will be excavated through. A grid-by-number bed material sample is required as the minimum description of bed material in the old channel.

Gravel Removal:

(20) Dimensioned sketches clearly dimensioned to describe the size and extent of the proposed gravel removal are required. A description of the project is desirable. The description should describe the type of material (eg. sand, gravel) to be removed, the amount to be removed, and the method of removal.

Settling Ponds:

(21) Dimensioned sketches clearly dimensioned to describe the settling pond are required.
A note on the type of particle to be settled, etc. would be helpful.

Channel Cleaning, Debris Removal:

(22) Dimensioned sketches clearly describing the size and extent of the proposed channel cleaning or debris removal project are required. A description of the project is required. The description should contain the following information:
(a) the type of bed material eg. sand, gravel,
(b) the types of debris to be removed, ex. scrap metal or dead vegetation,

(c) the method of removal,
(d) the method of disposal of removal material.

Tree and Brush Removal within 10 m. of the Bank:

(23) Dimensioned sketches clearly describing the nature and extent of the proposed tree and brush removal project are required.

(24) A description of the project is required. The description should be specific on the type of vegetation being removed.

Pool Restoration:

(25) Sketches fully dimensioned to describe the nature and extent of the pool restoration must be submitted detailing:
(a) the type of bed material,
(b) the amount of material to be excavated, pool dimensions originally and at present,
(c) the disposal of excavated material, and
(d) the use of machinery.

Fords:

(26) Dimensioned sketches describing in full the location and extent of the proposed watercourse alteration are required.
A full description of the proposed ford is required including information on:
(a) the bed of the watercourse,
(b) the nature of the ford, temporary or permanent,
(c) the vehicles potentially using the ford,
(d) the type and source of any material used in the construction of the ford.

(27) A description of the fisheries resources of the Stream by a biologist is desirable.

Beaches:

(28) Dimensioned sketches fully describing the location and extent of the proposed beach are required.

(29) A description of the proposed beach is required including information on:
- (a) the amount and type of material to be used to create the beach,
- (b) the methods used to protect the beach from erosion or increased sedimentation.

Instrument Pools and Wells:

(26) Dimensioned sketches describing in full the location and extent of the proposed watercourse alteration are required.

A full description of the proposed ford is required including information on:
- (a) the bed of the watercourse,
- (b) the nature of the ford, temporary or permanent,
- (c) the vehicles potentially using the ford,
- (d) the type and source of any material used in the construction of the ford.

Erosion Control Works:

(30) A full description of the proposed project must be submitted with sketches fully dimensioned to describe the size, shape and alignment of the erosion control work.

The description should include details on the material and method of construction.

Flood Protection Works:

(31) Flood protection works usually consist of a combination of measures which differ from the previously listed types of alterations only in the purpose that they serve. Refer to Table 1.1 and follow it for each protective work proposed.

Floodwater Diversion Channels (floodways):

(32) Drawings to scale must be prepared to submit with the application. There should be a plan, profile and sufficient cross-sections to define the alignment shape and size of the channel.

The drawings should note the soil or other material through which the channel will be located.

Modifications to Major Obstructions:
(Obstructions including those listed in Groups 1A to 1D inclusively) -

(33) Engineering scale drawings must be prepared to describe the size, shape, etc. of any changes to the structure. Refer to the requirements for the construction of a new structure.

Modifications to Major or Minor Alterations to the Natural Environment (alterations included in 1E to 2H inclusive)-

(34) Dimensioned sketches fully describing the size, shape, etc. of any changes to the original structure. Refer to the requirements for the construction of a new structure.

Modifications to Protective Works:

(35) Similar requirements to that for construction of protective works.

Removal of Major Obstructions:
(Obstructions including those listed in Groups 1A to 1D inclusive)-

(36) Drawings to scale plus a removal procedure are required. The scale drawings should fully describe the size, shape and alignment of the watercourse alteration. The removal procedure should include details about any blasting.

Removal of Minor Obstructions and Alterations:

(37) Dimensioned sketches plus a removal procedure are required. The dimensioned sketches should be fully descriptive of the size, shape and alignment of the watercourse alteration. The removal procedure should include details about any blasting.

Removal of Protective Works:

(38) Same as (37) plus details on the application form regarding the need for, or, appropriate protection measures in the period following removal.

Draining of Ponds, Lakes and Swamps:

(39) Drainings to scale plus a full description of the proposed changes must accompany the application. There must also be supporting evidence that the draining of the lake or swamp would result in a case of demonstrated public benefit. A positive cost/benefit analysis must be presented to support any proposal.

A person planning to drain a lake or swamp must prove that he or she owns all the land surrounding that lake or swamp.

Miscellaneous Drainage Changes:

(40) Dimensioned sketches and a full description of the proposed changes is required including comments on land use changes and changes in the amount of runoff.

APPENDIX F

THE COMMITTEES

THE COMMITTEES

THE WATERCOURSE ALTERATION ADVISORY COMMITTEE:

Name:

The Watercourse Alteration Advisory Committee may also be called The Watercourse Alteration Advisory Board or the Advisory Board.

Purpose:

The Watercourse Alteration Regulations is intended to protect the environment -- in particular, to control man-made changes to watercourses which may adversely affect the aquatic habitat and riparian property.

In order to coordinate the activities of the various government agencies in administering their respective Acts and to provide a more efficient service to the people of New Brunswick, the Watercourse Alteration Advisory Board was formed.

Scope:

The Watercourse Alteration Advisory Board deals chiefly with procedures and policy. It reviews the operation and effectiveness of the Watercourse Alteration Program, and provides advice to the regulatory agency.

The Advisory Board reviews proposals which would affect more than one agency. These may include changes in forms, application review requirements, required documentation and regulation revisions. The Advisory Board does not become involved with the review of applications for Watercourse Alteration Permits or the revision of guidelines in the Technical Guidelines, unless to resolve serious conflicts between the agencies involved. However, revisions made to the Technical Guidelines must be approved by the Advisory Board before implementation.

Representation:

Senior civil servants, or their delegates, from the

Water Resource Planning Branch, Environmental Management, Land & Water Use Division, N.B. Dept. of Municipal Affairs and Environment
Engineering Branch, N.B. Dept. of Agriculture
Fish and Wildlife Branch, N.B. Dept. of Natural Resources and Energy
Fisheries and Oceans Canada
Forest Branch, N.B. Dept. of Natural Resources and Energy
Research and Development Branch, N.B. Dept. of Tourism, Recreation and Heritage
Structures Branch, N.B. Dept. of Transportation

THE WATERCOURSE ALTERATION TECHNICAL COMMITTEE:

Name:

The Watercourse Alteration Technical Committee should be referred to only by its full name to avoid confusion with other technical committees.

Purpose:

The Watercourse Alteration Technical Committee is intended to be a forum for the exchange of information, ideas and suggestions on the criteria and precautions to be utilized during the design and construction of watercourse alterations.

Scope:

The responsibilities of the Technical Committee are twofold. Its primary function is to make revisions or additions to the Technical Guidelines, providing that these alterations do not involve procedural changes directly affecting more than one department. Its second function is to make recommendations to the Watercourse Alteration Advisory Committee regarding procedural aspects of the program dealing with the processing of applications, enforcement of the regulation, and public information. Upon instruction from the Advisory Committee, the Technical Committee may be charged with responsibility of preparing public information brochures and documents to supplement the Technical Guidelines.

Representation:

The New Brunswick Watercourse Alteration Technical Committee consists of representatives of various government departments having an interest in watercourse alterations and the protection of the Province's rivers and lakes. These representatives may include those employees who work regularly on the Watercourse Alteration Program.

Agencies regularly represented on the Watercourse Alteration Technical Committee are:

1. N.B. Department of Municipal Affairs and Environment

   Environmental Management, Land and Water Use Division, Water Resource Planning Branch
   Environmental Protection Branch

2. Fisheries and Oceans Canada

   Research and Development Branch
   Habitat Protection

3. N.B. Department of Natural Resources and Energy

   Fish and Wildlife Branch
   Mineral Resources Branch
   Forests Branch

4. N.B. Department of Agriculture

   Agricultural Engineering Branch

5. N.B. Department of Transportation

   Structures Branch

6. N.B. Department of Tourism, Recreation and Heritage

   Technical Services Branch
   Archaeology Branch

7. N.B. Department of Fisheries

   Technical Services Branch

8. Environment Canada

   Inland Waters Directorate
   Water Resources Branch